Carleton University

1978–79
Calendar

Faculty of Graduate Studies
and Research

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and Research
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Calendar

Carleton University
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Ottawa, Canada K1S 5B6
(613) 231-4403

Office of the Dean

Room 215, Paterson Hall
(613) 231-4403

Dean of Graduate Studies and Research
Gilles Paquet

Office Hours
September 1 to April 30
9 a.m. to 12 p.m.
1 p.m. to 5 p.m.

May 1 to August 31
8:30 a.m. to 12 p.m.
1 p.m. to 4:30 p.m.

As this Calendar is published several months before the opening of the session, the University reserves the right to make whatever changes circumstances may require, including cancellation of particular courses.

Table of Contents

Carleton University

Ottawa, the capital of Canada, is a medium-sized, nonindustrial city located at the junction of the Ottawa, Gatineau and Rideau rivers. Excellent skiing facilities, water recreation areas, and scenic areas are located in the Gatineau Hills a few minutes away from the campus. The National Arts Centre with its own orchestra, the National Gallery of Canada, and other such institutions give the city a well-rounded cultural environment. Entertainment is available in both of Canada's official languages, French and English.

Carleton was founded in 1942 as a nondenominational, private and coeducational college. Initially it occupied scattered rented quarters in downtown Ottawa but by 1946 it had moved to a permanent building in central Ottawa. As the University expanded, it became necessary to plan and develop a new campus. In 1954, the University moved to a new campus located on a large and picturesque site between the Rideau River and the Rideau Canal.

The University awarded its first degrees in 1946, but it did not offer programs of graduate studies until 1954. Carleton's first undergraduate degrees, awarded in 1946, were in journalism and in public administration; its first graduate diploma in 1954 was in public administration. By now, 24 years after the beginnings of its graduate studies, the University also offers graduate instruction leading to the Master's degree in some 30 areas and to the doctorate in a dozen fields. In 1977-78, Carleton registered 966 full-time graduate students. In addition, 768 students were registered for part-time graduate studies.

Carleton has set as its major goals in graduate studies the promotion of a spirit of independent investigation and the pursuit of scholarly work of consistently high quality. By concentrating on certain fields of studies to the exclusion of others and by electing areas in which it had a comparative advantage, the University has been able to ensure a great measure of success in the pursuit of these goals.

Carleton University has a good base of operation at the graduate level: outstanding scholars, challenging and imaginative programs of studies, students of high quality, libraries, laboratories and other research facilities. Moreover, the location of the University in the capital of Canada also enables graduate students to have access to the vast number of scholars working in government organizations and departments and to take advantage of research and library facilities associated with these national institutions.

Degree Programs

The following graduate programs are currently offered at Carleton:

Graduate Diploma in Public Administration (D.P.A.)

Master of Arts (M.A.)
In anthropology, Canadian studies, classics, comparative literature, economics, English, French, geography, German, history, international affairs, philosophy, political science, psychology, public administration, religion, Spanish, sociology and Soviet and East European studies

Master of Engineering (M.Eng.)
In aeronautical, civil, electrical, mechanical and materials engineering

Master of Journalism (M.J.)

Master of Science (M.Sc.)
In biology, chemistry, geology, information and systems science, mathematics, and physics

Master of Social Work (M.S.W.)

Doctor of Philosophy (Ph.D.)
In biology, chemistry, economics, engineering (aeronautical, civil, electrical, and mechanical), geology, history, mathematics, physics, political science, psychology, and sociology

Academic Dress

The academic dress of Carleton University is a compromise between the style of hoods outlined in the American Intercollegiate Code and

the dress of the ancient foundation of Britain and America.

The Master's hood, made of black silk, is of simple or Oxford shape with an open lining of two chevrons (red and black) on a silver field. The border of the hood denotes the degree granted, according to the following colour combinations: Arts — white; Journalism — white with a black cord sewn slightly in from the lower border; Science — golden yellow; Social Work — cream; Engineering — orange. The Master's gown is of full style, made of black silk or rayon, with full gathered yoke behind and closed sleeves with an opening at the elbows.

The Doctor of Philosophy hood is also made of silk, but completely opened to show the lining, and provided with a purple border. The doctoral gown has the same style as the Master's and is made of royal blue cloth with facings of light blue silk.

The gown of the Honorary Doctorate of Laws, of Science, or of Engineering is a blue robe with bell-shaped sleeves, made of fine royal blue cloth with facings and sleeves in light blue silk. The hood is made of the same material as the gown, has the same lining as that for the degrees granted by examination, and is bordered with purple for the degree of Doctor of Laws, dark red for the degree of Doctor of Science, and orange for the degree of Doctor of Engineering.

Academic Schedule

The following schedule of dates is anticipated for academic activities and procedures; however, it is subject to final confirmation by the University Senate.

Spring Term and Summer Session 1978

May 15, 16
Registration for spring term.

May 17
Spring term classes begin.

May 22
Statutory holiday, University closed.

May 30
Last day for late registration for spring term. Last day for spring term course changes.

June
Spring Convocation for the conferring of degrees; date to be announced.

July 3
Statutory holiday, University closed.

July 4
Registration for summer session day division.

July 5
Summer session day classes begin.

July 11
Last day for late registration for summer session. Last day for summer session course changes.

August 7
Civic holiday, University closed.

August 16
Last day for spring term and summer session classes. Last day for withdrawal from spring term and summer session courses.

August 17-19
Spring term and summer session examinations.

Fall Term 1978

June 2
Last day for the receipt of applications for fall term registration from candidates whose documents originate outside Canada. Supporting documents (transcripts, letters of reference, etc.) must be received by June 30. Applications from candidates in this category who intend to register initially for the winter term must be received by October 2, and for the spring term by February 1.

August 15
Last day for receipt of applications for fall term registration from candidates resident in Canada. Supporting documents (transcripts, letters of reference, etc.) must be received by September 1. Applications from candidates resident in Canada who intend to register initially for the winter term must be received by November 1; and for the spring term by April 1.

September 1
Last day for receiving applications for degrees from potential graduates for Fall Convocation.

September 1
Last day for submission to the thesis supervisor of four examination copies of the Master's and Ph.D. theses for Fall Convocation.

September 4
Statutory holiday, University closed.

September 5-8
Registration of graduate students for the fall and winter terms.

September 11
Classes begin in all courses.

September 22
Last day for late registration for fall term. Last day for course changes for full courses and fall term half-courses. Last day for submission to the Graduate Studies Office of four final copies of Master's and Ph.D. theses for Fall convocation.

October 9
Statutory holiday, University closed.

November
Fall Convocation for the conferring of degrees; date to be announced.

December 8
Last day for fall term classes. Last day for withdrawal from fall term half-courses.

December 11-20
Mid-year examinations, including half-course finals, may be scheduled as announced.

Winter Term 1979

January 3
Winter term classes begin.

January 3-5
Registration for winter term.

January 16
Last day for course changes for winter term half-courses. Last day for late registration for winter term.

February 1
Last day for receiving applications for degrees from potential graduates for Spring Convocation.

February 19-23
Study period.

March 2
Last day for receipt of applications for admission from candidates who wish to be considered for the initial award (April 1) of financial assistance (including Carleton fellowships, scholarships and departmental assistantships) administered by Carleton University. Supporting documents (transcripts, letters of reference, etc.) must be received by March 15. Candidates whose applications are received after the March 2 deadline date may be eligible for the award of a fellowship, scholarship or assistantship by reversion. Awards by reversion are normally considered on or about May 15, August 15 and October 1.

April 2
Last day for submission to the thesis supervisor of four examination copies of the Master's and Ph.D. theses for Spring Convocation.

April 10
Last day of winter term classes. Last day for withdrawal from full courses and winter term half-courses.

April 13-15
Easter weekend, University closed.

April 16 - May 3
Final examinations may be scheduled as announced.

April 30
Last day for submission to the Graduate Studies Office of four final copies of Master's and Ph.D. theses for 1979 Spring Convocation.

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Admission Requirements

Graduates of recognized universities, with at least second-class standing, will be considered for admission to the Faculty of Graduate Studies and Research. The University's general policy on admission is outlined below, but all applicants should refer to the departmental statements in this Calendar for details concerning the specific or additional requirements of each department, institute, or school.

A combination of factors is taken into consideration in assessing the eligibility of a candidate for admission into one of the graduate programs:

- the performance of the candidate and the assessment provided by his/her referees as a measure of the likelihood that the candidate can successfully complete the course of studies and research defined by the Senate of the University for the given degree;
- the capacity of the graduate department, school or institute to provide a program of studies and research which would meet the expectations of the candidate as defined in his/her statement of academic interests and ambitions;
- the availability of a faculty member competent to supervise the academic program of studies and research of the candidate at the time.

Qualifying Year Program

Applicants who do not qualify for direct admission to the Master's program may be admitted to a Qualifying Year program. Applicants having undergraduate degrees which are comparable to a pass degree from Carleton University (rather than an Honours degree) will normally be admitted to a Qualifying Year Program.

If successful in this Qualifying Year, they may eventually proceed to the Master's program. However, admission to the Qualifying Year program does not imply automatic admission to the Master's program. At the end of the Qualifying Year program, the department will determine the student's eligibility to enter the Master's program, and the student will be informed of this decision by the Dean of the Faculty of Graduate Studies and Research.

Applicants for a Master's degree who have a program requirement of eight full courses or more (with the exception of Social Work and Public Administration) will register initially in the Qualifying Year program.

Master's Program

An Honours bachelor's degree or the equivalent (with at least second-class standing) is required for admission to the Master's program. The applicant must also be recommended by the department in which he plans to undertake his studies.

Applicants for a Master's degree who have a program requirement of seven full courses or less will register directly in the Master's program.

Doctoral Program

A Master's degree, with at least high second-class standing from a recognized university, is ordinarily required for admission into the Ph.D. program.

Applicants should note that of the Bachelor's, Master's, and Ph.D. degrees, only two may ordinarily be taken at Carleton University.

Application for Admission

Applications for admission to the Faculty of Graduate Studies and Research should be made on prescribed forms available from the major department or the Graduate Studies and Research Office and they should be submitted directly to the department.

Deadlines

Candidates whose documents originate outside Canada must apply by June 1. All other applications must be received no later than August 15.

Applicants wishing to be considered for financial assistance from Carleton University are reminded that they must submit their completed applications for admission by March 15.

Transcripts

Two detailed *official* transcripts of the applicant's entire university record must be sent to the chairman of the department concerned.

Letters of Reference

All applications must be supported by letters of recommendation from at least two faculty members with whom the candidate has studied, who are in a position to assess his potential for graduate studies and research. References from non-academic supervisors are not ordinarily acceptable, except in certain cases, such as that of a part-time student working in a research laboratory environment. All letters of reference are to be sent by the referees directly to the chairman of the department.

Proficiency in English

Proficiency in English usage is considered necessary to pursue graduate studies at Carleton University. Applicants whose native tongue is not English should be tested for proficiency in the English language; they should write to:
TOEFL,
Box 899,
Princeton, N.J. 08540
U.S.A.

Admissions Procedure

All applications for admission will initially be examined and evaluated by the department, institute, or school in which the applicant wishes to study. All supporting documents (transcripts, letters of reference, etc.) must be received before any application can receive formal consideration.

Completed applications of those students whom the department wishes to recommend for admission will be forwarded to the Dean of the Faculty of Graduate Studies and Research for consideration. The Dean's office will officially notify each applicant whose admission is approved.

The Statement of Standing on Admission issued to each newly-admitted student is valid only for the 12-month period stipulated on the form. If the applicant fails to register within this period of time, his admission and registration eligibility will lapse automatically. He may re-apply for admission.

Program Requirements

As part of the learning experience at Carleton, all graduate students are expected to take an active part in the teaching and/or research activities of the unit in which they are registered, either by serving as an assistant, a demonstrator, or by undertaking independent research work related to the research effort of the department, under the direction of their supervisors.

A description of each program offered under the auspices of the Faculty of Graduate Studies and Research is presented in the departmental program descriptions and details of courses section of this Calendar. Prospective applicants should note particularly the admission requirements, the fields in which advanced study and research may be undertaken, and the program requirements of each department in addition to the general regulations of the Faculty of Graduate Studies and Research spelled out in this section.

Qualifying Year Program

Students in the Qualifying Year will ordinarily register in five full courses (or the equivalent) at the senior undergraduate level. Of these five, no more than one course at the 200 level and no more than two at the 500 level may be taken.

Master's Program

The normal requirement for the Master's degree is five full courses, or the equivalent, of which at least four (including the thesis where applicable) must be at the 500 level. With departmental approval, the remaining one course may be selected from those offered at the senior undergraduate level, that is, at the 400 level.

Doctoral Program

The period of formal study and research required in the Ph.D. program will be at least two years of full-time study (or the equivalent) beyond the Master's degree.

The thesis will ordinarily carry a weight of about half of the total requirement of ten full courses or the equivalent.

Ordinarily, all courses taken for credit towards the Ph.D. degree must be at the 500 or 600 level.

Transfer of Credit

Graduate courses completed at another institution may be accepted in partial fulfillment of Carleton's degree requirements. Credit for such work will be determined by the Executive Committee of the Faculty of Graduate Studies and Research on the recommendation of the department concerned.

Full-time Master's candidates are allowed a maximum of two transferred full course credits; part-time students are permitted only one such course. If a Master's candidate is granted transfer credit for two full courses, his remaining three courses at Carleton must be at the 500 level.

Doctoral candidates may be given up to one year's credit for work completed at other universities, but must normally register for a minimum of one year of full-time studies thereafter at Carleton, during which time the thesis and comprehensive examination will be undertaken. Students admitted with transfer of credits in a Ph.D. program may be required to pass a qualifying examination upon entry.

Course work completed as a Special student at Carleton is not normally acceptable for degree credit in the Faculty of Graduate Studies and Research. In exceptional cases, transfer of credit may be permitted for a maximum of two such courses provided that the student has obtained high standing. The total number of transferable credits (that is, credits from another university and/or credits earned as a Special student at Carleton) is limited to two full courses or the equivalent.

A student formally admitted, and eligible to register in a graduate program, is not normally permitted to register at the same time in any other degree program or as an Undergraduate or Special student. Should he do so, credits may not be transferred.

Similarly, if a student, formally admitted to Carleton (but not yet registered), wishes to enroll in courses at another university, credit will be granted only if written permission is received from the Dean of Graduate Studies and Research. Such permission must be received in advance of registration for the course work.

Language Requirements

Some graduate programs require a reading knowledge of one or more languages other than English. Language requirements will be prescribed by departments according to their regulations and the needs of their students.

Registration and Course Selection

The Faculty of Graduate Studies and Research divides the calendar year into three terms, and the academic year (September-May) into two terms; each term comprises about 13 weeks of lectures or seminars. The first term of the academic year is designated as the *fall term* (registration period at the beginning of September); the second term of the academic year is designated as the *winter term* (registration period early in January). The third term of the calendar year is designated as the *spring term* (registration period in late May). Some graduate and senior undergraduate courses are also offered in the *summer session* (registration period early in July) which comprises approximately six weeks of lectures or seminars. The precise dates of registration for the fall, winter and spring terms and for the summer session are specified in the Academic Schedule of this Calendar.

All students enrolling at Carleton are required to register in their programs at designated times prior to the beginning of classes. They will initiate their registration procedures in their major department, from whom information concerning all phases of registration will be available.

Graduate students must have *written approval* from their departmental supervisor of graduate studies for initial course/program registration and for any subsequent course changes. This approval is also required for any undergraduate student who wishes to register in a graduate level course.

The onus to establish that a student is properly registered in a course rests with the student himself, who should be governed by regulations in this Calendar.

Credit will be granted only for those courses and research activities for which the candidate is formally registered. An unregistered student is not entitled to attend lectures, tutorials, or seminars and is not entitled to thesis supervision, examination privileges or access to research facilities. A student will receive no credit for any work completed during a term in which he was not properly registered.

Course Selection

A student proceeding to a graduate degree or diploma must arrange his program according to the regulations of the Faculty of Graduate Studies and Research and the major department, and must have his selection of courses approved by the department during registration.

The course and thesis requirements of each graduate program are organized or defined in units of full course credits. A full course credit typically comprises three hours of lectures or seminars a week for two terms, or the equivalent. A half-course credit typically comprises three hours of lectures or seminars a week for one term, or the equivalent.

Course Numbering System

Each course is identified by a seven-symbol code. The first two digits indicate the department, school or committee under whose auspices the course is offered; the three digits following the decimal point identify the specific course; the letter which follows the course number designates the term in which the course is offered: for example, F: fall term, W: winter term, S: spring term, and T: two terms (fall and winter or winter and spring, etc.). The number which follows the letter indicates the credit weight of the course: 1 denotes one half-course credit, 2 denotes one full course credit, etc.

Status

A full-time graduate student will normally register in a minimum of three half-courses (or the equivalent) per term.

Part-time students are permitted to enroll in a maximum of two half-courses per term.

All students are reminded that status is established only by formal registration in the appropriate courses for each term of activity in the calendar year. See also Continuous Registration.

Definition of Full-time Study

In addition to the *course load* requirements described above, the following criteria for full-time status have been established by the Ontario Ministry of Colleges and Universities:

- The student must identify himself as a full-time student, that is, he must so register during each term of activity.
- The student must be geographically available and visit the campus regularly; he may not be absent from campus without permission for a period exceeding four weeks in any term. Students wishing to undertake full-time studies off-campus must secure, in advance, the written permission of the departmental chairman and the Dean of Graduate Studies and Research. (See Off-campus Research)
- A full-time graduate student may not be regularly employed on work not directly related to his/her program for more than an average of ten hours per week during any period of full-time registration.

Off-campus Research

In the interest of enriching their learning experience, graduate students may arrange to undertake full-time studies or research at another institution or in the field. It should be understood that such activity would apply only to a part of the total program and that the off-campus period would not normally exceed 12 months.

Requests for permission to undertake full-time off-campus study or research must be submitted, well in advance, to the Dean of Graduate Studies and Research, through the department concerned. Such requests should include the following information:

- a detailed statement of the research proposal or program of studies and the specific arrangements that are proposed for the supervision and direction of the work;

- an explanation of the reasons why the work cannot be satisfactorily undertaken while on-campus at Carleton;
- a description of the studies and/or research facilities that are available at the proposed off-campus location;
- a written statement from a responsible official (for example, the on-site supervisor or director) of the outside institution confirming that the proposed arrangements are satisfactory and that the candidate will be able to undertake research or studies;
- a time-schedule for the proposed studies or research work;
- a statement of the candidate's expected sources of financial support.

Inter-university Cooperation in Graduate Instruction

Under certain circumstances it is permissible for a student admitted to a graduate degree program and registered at one Ontario university to follow approved credit courses at another university. All interested students should consult the chairman of their department prior to registration in order to obtain further information on conditions of eligibility and procedures.

University of Ottawa

Through a reciprocal agreement, a full-time graduate student registered at Carleton University may be permitted to follow up to two full courses at the University of Ottawa. Moreover, there are reciprocal arrangements worked out between departments, institutes and schools at both universities to involve students, when it is desirable, in parts of the program of research and studies at the other institution. All interested students should consult the chairman of their department, institute or school, prior to registration, in order to obtain further information on particular departmental conditions of eligibility and procedures.

Continuous Registration

Any candidate who remains unregistered in his degree program for three terms (12 months) will lose his graduate status.

Continuous Registration in Thesis or Research Essay

Any candidate (full-time or part-time), after initial registration in a thesis or research essay, must maintain this registration in all successive terms until his/her thesis or research essay is completed (including the term in which the student is examined in the thesis or research essay). Completion means modifications, any retyping involved, etc., of the four final copies of the thesis or research essay for deposition in the Graduate Studies and Research Office.

Whether a student registers on a full- or part-time basis is determined by the amount of time devoted to graduate studies and research, the demands on university personnel, resources and facilities.

Registration by mail is acceptable for part-time students, provided that the prescribed form is completed and returned (through the department concerned) together with fee payment (cheque or money order) before the last date for course changes in each term.

The per-term fee for part-time registration is equivalent to the prevailing fee assessment for a half-course. Details of fees for students completing theses and research essays on a full-time basis can be found on page 26.

Off-campus Registration

Students who have been permitted to study off-campus, while registered full-time at Carleton, or who are registering in theses or research essays, may register by mail. Registration forms may be obtained from the Graduate Studies and Research Office upon request.

Thesis Registration Assessment of Part-time Students

Students who elect to complete their theses on a part-time basis will be assessed prorated fees that reflect the credit weight of their theses. In other words, a student enrolled in a Ph.D. thesis, worth six credits, will be assessed a fee equivalent to one full course *per term* for the first six terms in which he registers in the thesis as a part-time student. Thereafter, the fee for registration is equivalent to the prevailing fee assessment for a half-course.

Audit Courses

Graduate students may register to audit *one course per program*. Full-time students will not be charged an additional fee; part-time students must pay the prevailing per-course fee.

Tutorials

These are arranged to allow students to take full advantage of all the resources of the University, even in areas or fields of a more highly specialized nature. Such arrangements are subject to the approval of the supervisor of graduate studies, who will arrange that a document spelling out the details of the topic, reading list, etc., is submitted to the Faculty of Graduate Studies and Research before the last day for course changes in the term concerned.

Course Changes

A course change is the addition or deletion of one or more individual courses by a registered graduate student. This is the only acceptable procedure for revising or correcting a graduate student's registration. All course changes must be made on prescribed Course Change Forms available at the departmental offices or the Graduate Studies and Research Office.

A part-time student who is registered in two courses and drops one of these may be entitled to a *pro rata* fee credit or refund, depending on the length of time elapsed since the beginning of the term.

The deadline dates for course changes are stipulated in the Academic Schedule of this Calendar.

Withdrawal

A graduate student wishing to terminate his registration in a graduate program (that is, drop all courses) must complete the prescribed Withdrawal Form (or apply in writing to the Dean of Graduate Studies and Research) and return his identity card.

When a student officially withdraws, with the approval of the Dean of Graduate Studies and Research, a refund of fees will be calculated on a *pro rata* basis as of the date of receipt of the Withdrawal Form (or letter) and the identity card. Credit for fees or refunds will depend on the date of withdrawal, the amount of fees paid, and the length of time elapsed since the beginning of the term.

Graduate students are cautioned that there is no procedure at Carleton University for direct "mid-term" transfer from one graduate program to another. Similarly, there can be no direct transfer to or from undergraduate or Special student status. Any candidate who elects to change programs after registration (*before* the last day of late registration) will be required to withdraw from the first program and then register in the second. The *pro rata* refund of fees calculated as a result of withdrawal from the first program can be applied against the new fee assessment for the second program.

A registered candidate who completes his degree or diploma requirements prior to the last day for withdrawal in any term (as specified in the Academic Schedule) is required to withdraw formally if he anticipates any refund of fees. A candidate whose degree program has been completed is not eligible for further registration in the Faculty of Graduate Studies and Research (unless he has been admitted to some other graduate program).

Exemption from Registration

Students who have valid reasons for not registering for a term may apply for permission to remain unregistered by:

- writing to the Dean of Graduate Studies and Research stating the reasons for seeking exemption from registration;
- requesting a statement from the departmental supervisor of graduate studies (and from their thesis supervisor, if there is one) in support of their request, confirming that they will not be on campus for the term, will not use any University facilities (that is, library, laboratories, computer centre, etc.) or receive any supervision, including supervision through correspondence.

It is understood that such an exemption from registration will be granted only in exceptional cases (for example, medical or other special reasons).

Exemptions are normally granted for one term, but in extraordinary circumstances for a longer period.

Examinations

Final examinations in courses will be held at the times indicated in the Academic Schedule. Graduate students must obtain grades that meet the standards outlined in the Academic Standing section of this Calendar, and that satisfy the specific requirements of the department concerned.

A graduate student who is unable to write a final examination because of illness or other circumstances beyond his control, or whose performance on the examination has been impaired by such circumstances, may apply to write a special or deferred final examination.

Such an application will be considered only if it is submitted in writing to the Dean of Graduate Studies and Research within two weeks of the examination.

If the student has been seen at the University Health Services, the Dean's office will confirm the illness by contacting the treating physician. If the student has consulted a physician outside the University, the student will be required to submit a statement (from the physician) confirming the illness.

In cases other than illness, appropriate documents will be required.

Supplemental or other grade-raising examinations are not permitted for students registered in the Faculty of Graduate Studies and Research. Graduate students may, however, with the permission of their department, repeat a course at the time of next regular offering to obtain higher standing.

Master's Examinations

In addition to any examination which may be required in individual courses, a Master's candidate who is writing a thesis will be expected to undertake either an oral defence of the thesis or a comprehensive examination in his field of specialization, or both. The thesis must be submitted, in examinable form, at least two weeks in advance of the thesis examination. When the degree is taken by course work, a comprehensive examination may be required. It is important to note that individual departments may have additional or particular requirements.

Doctoral Examinations

Doctoral candidates may be asked to pass a qualifying examination at the beginning of their residence at Carleton.

A comprehensive examination covering prescribed fields will normally be undertaken one year prior to the thesis presentation. This examination (oral or written, or both) may include any material considered fundamental to a proper comprehension of the field of study.

After the thesis has been received and approved, a final oral examination on the subject of the thesis and related fields will be held. Such thesis examinations will be scheduled upon receipt of theses, which must be submitted at least four weeks in advance of the date of the examination.

Comprehensive and Thesis Examinations

The date, place and time of comprehensive or thesis examinations will be announced at least two weeks in advance. An examining board will be appointed according to the guidelines laid down by the Faculty of Graduate Studies and Research.

If the comprehensive examination is graded *Unsatisfactory*, the department may permit the candidate to repeat the examination. If the comprehensive examination is graded unsatisfactory for a second time, a request by the department that the candidate be allowed to continue in the program would require the approval of the Executive Committee of the Faculty of Graduate Studies and Research.

The comprehensive and thesis examination processes must be conducted according to the principles and practices prescribed by the Faculty of Graduate Studies and Research.

Grading System

Carleton University employs the 12-point system of letter grades to represent standing in graduate lecture courses, directed studies,

seminars, tutorials and some research essays and theses. The letter grades used, and the grade point equivalents, are as follows:

A +	12	B +	9
A	11	B	8
A–	10	B –	7
C +	6	D +	3
C	5	D	2
C –	4	D –	1

Under certain defined circumstances, notations are used instead of letter grades to represent standing. The only notations permissible in the Faculty of Graduate Studies and Research are the following:

- A notation of *Satisfactory* or *Unsatisfactory* may be assigned, subject to the approval of the Faculty of Graduate Studies and Research, in certain very special courses involving practicum, field work, or other complex activities not easily adaptable to the 12-point system of grading.
- Comprehensive examinations are graded *Pass With Distinction*, *Satisfactory*, or *Unsatisfactory*.
- The Master's thesis is graded *Pass With Distinction*, *Satisfactory*, or *Unsatisfactory*, or it may be assigned a letter grade. The oral defence is graded *Satisfactory* or *Unsatisfactory*.
- The Ph.D. thesis and its oral defence are each graded *Satisfactory* or *Unsatisfactory*.
- A notation of *Incomplete* may, subject to the approval of the chairman of the department, be assigned to a course in which the student has been granted the privilege of submitting an assignment after the final deadline date. This notation of *Incomplete* will be permissible only in exceptional cases, (for example, medical or other special reasons) and must be replaced with a letter grade within 40 days of the end of classes. If the notation of *Incomplete* is not changed to a letter grade (through the regular change-of-grade procedures) within 40 days of the end of classes, the notation will remain as a permanent entry for that registration in the course. However, the student may register to repeat the course in order to obtain letter grade credit.
- A notation of *Absent* will be assigned to any course in which the student failed to attend the final examination. If the student explains his absence (in writing) to the Dean of Graduate Studies and Research within 14 days of that examination, he may be granted the privilege of undertaking a special or deferred examination. The notation of *Absent* will also be assigned where a student has terminated a course without formally withdrawing from the course prior to the end of classes.
- If a thesis or research essay is not completed by the end of the period of registration, a notation of *In Progress* will be recorded. This notation must be replaced by an appropriate final notation or grade (as specified above) after the thesis or research essay has been examined. In cases where a student has registered in a research essay or a thesis, without completing it, and later undertakes course work to complete the degree program — or loses graduate student status in his program — the notation *In Progress* will be changed to *Incomplete*.

Academic Standing

Qualifying Year

The general regulations governing academic standing in the Qualifying Year conform to those of the Master's program.

Master's Program

A grade of B– or better must normally be obtained in each course counted towards the Master's degree. A candidate may, with the recommendation of his department, be allowed a grade of C+ or C (but not C–) in one full course or each of two half-courses.

Full-time Master's candidates who fail to achieve a weighted grade point average of 7.0 after two terms of study will be required to withdraw from the program. In the event of special or extenuating circumstances, the student may apply to the Executive Committee of Graduate Studies and Research for permission to continue in the program.

A part-time Master's student who fails to achieve or maintain a weighted grade point average of 7.0 after completing two full courses (or equivalent) will be required to withdraw from the program.

In addition to the above requirements, departments will undertake a periodic evaluation of a student's progress in his or her overall program of studies and research to determine whether that progress is satisfactory. In the event of that progress being deemed unsatisfactory, the student may be asked to withdraw.

Doctoral Program

Doctoral students must normally obtain a grade of B- or better in each course counted towards the degree.

In addition to the above requirements, departments will undertake a periodic evaluation of a student's progress in his or her overall program of studies and research to determine whether that progress is satisfactory. In the event of that progress being deemed unsatisfactory, the student may be asked to withdraw.

Thesis Requirements

General Remarks

The thesis is a major requirement of most programs and, in conjunction with the research for it, makes up at least one-half of the time normally required for the program. The thesis must be expressed in a satisfactory literary form, consistent with the discipline concerned, and must display a scholarly approach to the subject and thorough knowledge of it. A critical review of previous work related to the subject should usually be given.

Master's Thesis

The Master's thesis should embody the results of successful scholarly research in a specialized area. It should exhibit the candidate's knowledge of recognized techniques of investigation and critical evaluation, and be presented in an organized and systematic way.

Candidates are ordinarily required to undertake an oral examination on the thesis. Notice of this examination will be given at least two weeks in advance by the chairman of the department.

The Master's thesis will be examined by a board consisting of at least three members, including the thesis supervisor, the chairman of the department concerned, and an examiner from a department other than that of the candidate.

The constitution of the examining board will be announced by the chairman of the department concerned; both it and the thesis examination process are defined by guidelines, principles and practices prescribed by the Faculty of Graduate Studies and Research.

Thesis weight (one to two full courses) must be identified at the time of admission. A change in the thesis weight at a later date would require the approval of the Executive Committee of the Faculty of Graduate Studies and Research.

Doctoral Thesis

The Ph.D. dissertation must report, in an organized and scholarly fashion, the results of original research. The thesis must be a contribution to knowledge, and must demonstrate the candidate's ability to undertake sustained research and to present his/her findings in an appropriate manner.

The dissertation must be defended successfully at an oral examination. Notice of this examination will be given at least two weeks in advance by the Dean of the Faculty of Graduate Studies and Research.

The Ph.D. dissertation will be examined by a board consisting of at least five members, including the thesis supervisor, the chairman of the department concerned, an examiner from a department other than that of the candidate, the members of the candidate's advisory committee, the Dean of the Faculty of Graduate Studies and Research or his delegate, and an external examiner who is a recognized authority on the subject of the thesis.

The constitution of the examining board will be announced by the Dean of the Faculty of Graduate Studies and Research; both it and the thesis examination process are defined by guidelines, principles and practices prescribed by the Faculty of Graduate Studies and Research.

Thesis weight (ordinarily about half of the total Ph.D. requirement of ten full courses) must be identified at the time of admission. If the thesis weight falls within a range of credit

weights, it should be assigned at the time of admission a weight corresponding to the lower bounds of that range. A change in the thesis weight at a later date would require the approval of the Executive Committee of the Faculty of Graduate Studies and Research.

The work of each Ph.D. candidate will be assisted by an advisory committee of faculty members who will aid him/her in his/her preparation for the final comprehensive examination and assist in the evaluation of the thesis and oral examinations.

Deadlines

A Master's student expecting to graduate at the Spring Convocation must submit his/her thesis or dissertation to his/her supervisor, in examinable form, by *April 1.* A Master's student expecting to graduate at the Fall Convocation must submit his/her thesis by *September 1.*

A Ph.D. student expecting to graduate at the Spring Convocation must submit his/her thesis or dissertation to his/her supervisor, in examinable form, by *April 1.* A Ph.D. student expecting to graduate at the Fall Convocation must submit his/her thesis by *September 1.*

Specifications

- The candidate must submit *four* typewritten copies (original and three carbons or acceptable duplicated copies, on bond paper) and must comply with special departmental requirements governing the form of the thesis, including methods of bibliographical entry and use of diagrams and tables.
- Each thesis or dissertation must be accompanied by a suitable abstract. The abstract of a Master's thesis should not exceed 150 words, while the abstract of a Ph.D. thesis may be up to 600 words in length.
- Regulations regarding style, pagination, certification, acceptance, grade and size of paper, as well as abstracts, reproduction, microfilming, binding, and constitution of the examining board will be prescribed by individual departments.

The candidate is expected to notify his/her supervisor and the chairman of the department (as least two weeks in advance) of the date on which he/she intends to submit *four* copies of his/her completed thesis. The thesis examination and defence will be scheduled and the date announced at least two weeks in advance.

- The four unbound copies of the approved thesis submitted to the Faculty for binding should be the original and three others and must be presented in order of pagination in separate envelopes; the third copy is given to the department; the fourth copy is for the candidate.

License to the University and to the National Library of Canada

In the interest of facilitating research by members of the Carleton community and by interested outsiders, and in consideration of his/her having been accepted as a graduate student at Carleton, the student author of a thesis, dissertation or research essay submitted in partial fulfillment of the requirements for an advanced degree, shall grant to the University and to the National Library of Canada a license to make single copies or microfilms (solely for the purpose of private study and research, in response to written requests from individuals, libraries, universities or similar institutions).

It is understood that the student author retains other publication rights, and that neither the thesis, dissertation, research essay, nor extensive extracts from them, may be printed or otherwise reproduced without the author's written permission.

Withholding of Thesis Deposition

If, at the time of submitting his/her thesis, the student elects to protect any rights to immediate commercial publication, or to obtain a patent which may arise from his/her research, or to keep his/her thesis out of circulation for other reasons, he/she may apply in writing to the Dean of Graduate Studies and Research requesting that the thesis be withheld from deposit in the library:

- for an initial period of three months without reason;
- for each additional period of six months, with reason (total period of restriction not to exceed two years).

The student must submit any request for extension of the restriction one month prior to the

termination of the previous period. The student and his/her supervisor will be required to justify the extension of the restriction. Subsequent requests must follow the same procedure.

Time Limits

There are maximum time limits for the overall programs. Candidates may also be subject to time constraints prescribed by individual departments to ensure orderly progress through the stages of their programs.

Master's Programs

Full-time

A full-time Master's candidate must complete his degree requirements within six terms of registered full-time study and within an elapsed period of three calendar years after the date of initial registration.

Part-time

A part-time Master's candidate must complete his degree requirements within an elapsed period of six calendar years after the date of initial registration.

Combined Full-time and Part-time

A Master's candidate who elects to complete his program by a combination of full-time and part-time study is governed by the following elapsed-time limitation: five calendar years if the candidate is registered as a full-time student for two or three terms and part-time for the balance; four calendar years if the candidate is registered four or five terms as a full-time student and part-time for the balance.

Doctoral Programs

Full-time

A full-time Ph.D. candidate who is admitted on the basis of a Master's degree (that is, with a program of ten full courses or the equivalent) must complete the Ph.D. degree requirements within 12 terms of registered full-time study or within an elapsed period of six calendar years after the date of initial Ph.D. registration.

Part-time

A Ph.D. candidate who undertakes the program by a combination of full-time and part-time study must complete the degree requirements within an elapsed period of eight calendar years beyond the Master's level.

Extension of Time Limit

In exceptional cases, an extension of time (one or two terms) may be granted to a candidate whose recent progress (as judged by the department) has been otherwise satisfactory. Requests for extension of time should be directed to the Dean of Graduate Studies and Research through the department concerned.

Appeals

Academic Appeals

Within two weeks of the release of grades or the announcement of comprehensive examination results or thesis results, a graduate student may request, through the Dean of the Faculty of Graduate Studies and Research, that one or more of his grades or results be reviewed.

A graduate student also has the right to appeal decisions made concerning his graduate status or any other ruling related to his program of studies.

All such appeals are to be made in writing, with an explanation of the pertinent circumstances, to the Dean of the Faculty of Graduate Studies and Research. The appeal and the reply of the department concerned will be subsequently considered by the Executive Committee of the Faculty of Graduate Studies and Research.

Other Appeals

Appeals concerning matters of a non-academic nature should initially be directed to the Grievance Committee of the Graduate Students' Association.

If the problem is not resolved by this committee, in consultation with the administrative unit concerned, the matter will then be referred to the Dean of the Faculty of Graduate Studies and Research for consideration by the joint Grievance Committee of the Faculty of Graduate Studies and Research and the Graduate Students' Association.

Graduation

On the recommendation of the Faculty of Graduate Studies and Research and with the approval of the Senate of the University, degrees are conferred by the Chancellor. Convocations for the conferring of degrees are ordinarily held in the spring and fall of each year.

Students expecting to graduate at the Spring Convocation must apply for graduation in the Graduate Studies and Research Office by *March 1*. Those expecting to graduate at the Fall Convocation must apply by *September 1*.

Hours of Operation

Bookstore

Labour Day to May (end of examinations)
Monday to Thursday 9 a.m.—9 p.m.
Friday 9 a.m.—4:30 p.m.

Hours may vary and will be posted at the bookstore entrance.

Business Office

Labour Day to April 30
Monday to Friday 9 a.m.—5 p.m.
Monday to Thursday 7—9 p.m.

May 1 to Labour Day
Monday to Friday 8:30 a.m.—4:30 p.m.
Mondays and Thursdays only 6:30—8:30 p.m.

Library

Summer Session
Monday to Thursday 8:30 a.m.—10:30 p.m.
(10:30—11 p.m. study only)
Friday 8:30 a.m.—6 p.m.
Saturday 10:00 a.m.—5 p.m.
(5 p.m.—10 p.m. study only)*
Sunday 1 p.m.—8 p.m.
(8 p.m.—10 p.m. study only)*
*After summer day division begins in July.

Winter Session
Monday to Thursday 8:30 a.m.—10:30 p.m.
(10:30—11 p.m. study only)
Friday 8:30 a.m.—6 p.m.*
Saturday 10:00 a.m.—5 p.m.
(5 p.m.—10 p.m. study only)*
Sunday 12 noon—8 p.m.
(8 p.m.—10 p.m. study only)*
*Week-end study hours are extended to 11 p.m. during periods of heavy use.

When classes are not in session hours vary and are posted at the entrance.

The Alumni Association of Carleton University

The Alumni Association is an informal body which encompasses all graduates from the University. Its primary function is to contribute to the development of the University, academically and otherwise, with the objective of enhancing the effectiveness with which the University fulfills its role in society. As well, the Alumni Association exists to ensure mutually beneficial relations and communication between the University and its alumni and among the alumni themselves.

Alumni records are maintained by the Development Office, which is also responsible for all alumni fund-raising activities. Alumni communication programs are carried out through the Information Office. All alumni activities and programs are supervised by the Alumni Fund and Information Council, composed of a representative body of alumni volunteers.

Athletics and Recreation

The athletics and physical recreation program at Carleton, which plays an important role in maintaining and enhancing the University spirit, is coordinated by the Athletic Board, a committee consisting of students, faculty members and administrators.

At the intercollegiate level, Carleton is a member of both the Ontario University Athletic Association (for men) and the Ontario Women's Intercollegiate Athletic Association. Varsity programs for men include basketball, football, cross-country skiing, waterpolo and fencing. The women's teams participate in basketball, volleyball, cross-country skiing and fencing. Graduate students are eligible for intercollegiate athletics, subject to league regulations.

The intramural program includes touch football, cross-country skiing, basketball, broomball, badminton, swimming, curling and hockey. Some of these sports are coeducational although most are played separately by men and women.

Carleton's athletic facilities currently include football and soccer fields, outdoor hockey and skating rinks, five all-weather tennis courts, a 50-meter swimming pool, fitness centre, and a gymnasium complex which includes such facilities as squash courts, combatives room, gymnastics and multipurpose room, and a gymnasium. These facilities are available for use by Carleton students for organized and recreational sports activities.

Computing Services

Carleton University Computing Services operates a Xerox SIGMA-9 computer, which is located in the Computer Centre, on the fourth floor of the Administration Building. It can be accessed in both time-sharing and batch modes, and supports most of the University's research and teaching requirements. The SIGMA-9 is also used for the University's administrative data processing.

• Time-sharing Services

Time-sharing accounts for over 50 percent of the total use of Carleton's SIGMA-9 and nearly 60 percent of the academic usage:

Monday - Friday:	8:30 a.m. - 11:00 p.m.
Saturday	8:30 a.m. - 5:00 p.m.

In addition to these regular hours, the time-sharing system is usually available overnight during the week. This is not guaranteed, however, and outside the advertised hours time-sharing services may be interrupted at any time.

• Batch Processing Services

Computer Centre:
Administration Building

I/O Room	Room 408 (231-6723)
Monday - Friday	8:00 a.m. - 10:00 p.m.
Saturday	9:00 a.m. - 5:00 p.m.

Remote Batch Terminal Centres:

Loeb Building	Room C263 (231-2757)
Mackenzie Building	Room 351 (231-2748)
Monday - Friday	8:30 a.m. - 12:00 p.m.
	1:00 p.m. - 10:00 p.m.
Saturday	9:00 a.m. - 12:00 p.m.
	1:00 p.m. - 5:00 p.m.

• Consulting

Student programming consultants are available in the Administration Building, Loeb Building and Mackenzie Building. Posters in terminal areas should be checked for room numbers and hours of service. The Loeb consultants are there primarily to advise on social science computing applications; general computing problems should be referred to consultants at the Administration or Mackenzie Building.

Specialized consulting is also available, and problems that require special attention will be referred to the appropriate members of the Academic Support Group by the programming consultant.

• Computing Services Publications

Interface
A bi-monthly newsletter produced by Computing Services and available to all users. Copies are available at several distribution points on campus as well as at all batch submission sites. Back issues are available on request.

NEWS Bulletins
Issued when changes in operational procedures, etc., must be brought to the immediate attention of users. The bulletins are posted at each RBT centre and in the I/O room in the Computer Centre.

The Undergraduate Computer Reference Manual
An introductory guide to the use of terminals, the BASIC and EDIT processors, keypunch machines, etc.

The Researcher's Guide to Computing at Carleton
A guide to the use of the Carleton SIGMA-9, directed toward users who will be making extensive and varied use of the available computing resources.

Program Library Catalogue
This catalogue lists and briefly describes all the library programs and packages available on the system.

• Computer Accounts

In order to use the computer, it is necessary to have a computer account identified by an account number, name and password. Application forms for computer accounts are available from the accounts clerk at the Computer Centre (231-6313).

Counselling Services

The University Counselling Services is an educational resource centre available to all members of the University community. It provides a variety of learning experiences to facilitate personal growth and adjustment, maximum development of individual potential

and the realization of personal, academic and career goals. To this end, a qualified team of counselling professionals offers a wide range of services and programs.

All contacts with the University Counselling Services are voluntary and strictly confidential. Since confidentiality of records is respected and maintained, information is only released upon the request and consent of the client involved.

Other types of assistance include appropriate on- and off-campus referrals when required, and consultation regarding the problems of another person.

The centre is located in Room 305 of the St. Patrick's College Building with office hours from 9:00 a.m. to noon and from 1:00 p.m. to 5:00 p.m. Further information about services and programs may be obtained from the centre in person or by telephone (231-4408).

- Counselling Services

Personal counselling affords the opportunity of learning to deal more effectively with emotional and social concerns. Educational and career counselling involves learning to plan wisely, handle difficulties, and make decisions with regard to academic and vocational concerns. Individual and group approaches are used in providing counselling and therapy.

- Testing Service

A testing program is designed in consultation with a counsellor and constitutes an individual assessment according to the type of self-knowledge required. Relevant information generated by interest, personality, ability and achievement test results is used in helping to determine goals and make choices.

- Information Service

A career information library is maintained for use in educational and vocational planning. It includes materials on occupations, university and community college calendars, directories and other types of career literature. Information about Carleton and the greater Ottawa community is also available regarding other sources of assistance.

- Skill Development Service

Various programs and activities are designed to create learning experiences which further the development of effective reading and study skills. Testing, instruction and practice are provided to correct difficulties and improve the ability to learn and study. Individual and group approaches are utilized.

- Group Programs

These afford opportunities to be involved in a variety of experiences in which learning is best facilitated through group participation. They are offered periodically throughout the year. The nature and content of programs are publicized along with dates and registration details.

Day Care Centre

The Day Care Centre at Carleton operates in two locations on campus, Renfrew House Residence and the Lower Lounge of the Loeb Building. They are open all year except for statutory and University holidays and the hours are from 8:00 a.m. to 6:00 p.m., five days a week.

Currently the ages of children are 12 months to three years, and children must leave during the month in which they reach three years. Priority is given first to children of students, then to the children of faculty and staff at Carleton. Should there be vacancies, children will be taken whose parents are not affiliated with Carleton.

There usually is a waiting list, so it is advisable to apply some months before a place is actually required.

Inquiries should be addressed to the Director, Room 199, Loeb Building, telephone 231-6312.

Fees

Fees at Carleton are calculated on a composite basis to include tuition, the Students' Association and the Graduate Students' Association, Athletics, University Centre, and Health Services fees. The fees for the 1977-78 year are listed below because an approved schedule for the 1978-79 year was not available at the time that the Calendar went to press. It is anticipated that the fee structure will remain basically the same.

Canadian Citizens and Landed Immigrants

• Full-time

Master's Degree Program

* (first year of full-time study)

Tuition	$342.50
Students' Association	10.85
Athletics	16.65
Health	5.85
University Centre	6.65
Total composite fee (per term)	$382.50

(second or subsequent year of full-time study)

Tuition	$155.00
Students' Association	10.85
Athletics	16.65
Health	5.85
University Centre	6.65
Total composite fee (per term)	$195.00

Doctoral Program

(first and second year of full-time study)

Tuition	$342.50
Students' Association	10.85
Athletics	16.65
Health	5.85
University Centre	6.65
Total composite fee (per term)	$382.50

(third or subsequent year of full-time study)

Tuition	$155.00
Students' Association	10.85
Athletics	16.65
Health	5.85
University Centre	6.65
Total composite fee (per term)	$195.00

Qualifying Year and Diploma in Public Administration

Tuition	$680.00
Students' Association	32.50
Athletics	50.00
Health	17.50
University Centre	20.00
Total composite fee (academic year)	$800.00

• Part-time

Tuition	$133.20
Students' Association	6.50
Athletics	10.00
Health	3.00
University Centre	4.00
Total composite fee (per course)	$156.70

Students who require additional time on a *part-time* basis to complete theses or research essays must register for each subsequent term, at a per-term fee equivalent to the prevailing fee assessment for a half-course.

Foreign Students

• Full-time

Master's Degree Program

* (first year of full-time study)

Total composite fee (per term)	$ 790.00

(second or subsequent year of full-time study)

Total composite fee (per term)	$ 631.15

Doctoral Program

(first and second year of full-time study)

Total composite fee (per term)	$ 790.00

(third or subsequent year of full-time study)

Total composite fee (per term)	$ 631.15

Qualifying Year and Diploma in Public Administration

Total composite fee (academic year)	$1,620.00

• Part-time

Total composite fee (per course)	$ 323.50

*First and second year of full-time study for students in Public Administration and Social Work.

*First and second year of full-time study for students in Public Administration and Social Work.

Method of Fee Payments

Fees may be paid in accordance with either of the following: payment in full at the time of registration, or payment in two installments:

- at registration, half of the total tuition fee plus all miscellaneous fees (where applicable) plus a deferred payment fee of $.50 per half-course (four or more courses: $5.00);
- on or before January 15, the remaining half of the total tuition fee.

Scholarships, bursaries, and loans administered by the University will be applied first to fees, provided that this is not contrary to the terms of the award.

Personal cheques will be accepted for the payment of accounts, but the University reserves the right to cancel this policy if it is abused. A service charge of $5 will be assessed for each cheque returned to the University as non-negotiable for any reason. Students are requested to provide their own cheques when making payments.

A statement of tuition fees paid may be obtained for taxation purposes by applying to the Business Office in February.

Late Registration Fees

Full-time Students

$10 first week after the regular registration period.

$15 second and third weeks after the regular registration period.

Part-time Students

$5 per course after the regular registration period.

Examination Fees

Special Final Examinations Written at Carleton University

$10 per paper.

Examinations Written at a University Centre other than Carleton University (when permitted)

$20 per paper.

Transcript Fees

All students are entitled to two free copies of their official transcript. Additional copies will be issued at a charge of $1 for the first, $.50 for the second, and $.25 for each further copy (at any one time of ordering).

Reinstatement Fee

Students who have lost graduate student status and who later become reinstated in their programs are required to pay a reinstatement fee of $25.

Deposit — Gowns and Hoods

At each convocation, the University makes available to graduating students the appropriate academic regalia. A $25 deposit is required, which will be refunded when the regalia are returned.

Delinquent Accounts

Students with outstanding accounts (tuition fees, library fines, traffic violation fines, etc.) will not be permitted to register again until these accounts are paid in full.

Health Services

Health Services are provided to protect and improve the physical and mental health of the students and of the University community. Its responsibilities are to provide consultation, treatment and advice on matters of health, and to ascertain the fitness of students to perform academic work. When the necessary service cannot be provided by the program, appropriate referrals will be made. Confidentiality is respected at all times.

Health Services have regular hours and are staffed by physicians, nurses and psychiatrists.

Health Regulations

- Medical insurance is compulsory for all full-time students.
- All Ontario students should be covered by OHIP.
- Students from outside Canada should apply for OHIP. This application should be made as

early as possible as there is a delay in coverage after application.

Students who object to the above requirements on conscientious grounds must consult the University physician and provide a written statement giving the basis for such objection.

T.B. Control

All full-time students require a tuberculin skin test or chest X-ray if tuberculin-positive. These are required to be repeated on a yearly basis while attending university.

Housing and Food Services Residences

Residences

There are currently five residence houses on the Carleton campus which accommodate a total of 1,342 students in men's, women's, and coeducational living arrangements.

Residence accommodation is for full-time Carleton students, graduate and undergraduate. Currently there are no facilities on campus for married students. Within the residence, graduate students are accommodated in single rooms.

For application forms or further information, students should contact the Student Housing office, Room 223, Commons Building.

Off-campus Housing

An off-campus housing information service is available to students who are unable to obtain or do not wish to have on-campus residence accommodation. The service has been established to assist out-of-town students, but is in no way a rental agency.

Listings of available accommodations are posted in the second-level corridor of the Commons Building. This area is open seven days a week, night and day for your convenience.

Unfortunately it is not possible to mail out listings of accommodation as such lists become outdated too rapidly.

Food Services

All students residing in residence must take a full meal program (19 meals per week). Students living off campus may use the residence dining facilities by purchasing a campus dining plan, or eating individual meals in the dining halls. Additional dining, cafeteria and vending facilities are located throughout the campus.

Library Regulations

All persons registered at the University are entitled to use the Library. Graduate students may borrow most books for a period of up to four weeks, although some books are placed on "Reserve" and may be borrowed for five days only, or on an overnight basis. Alumni of Carleton University, on payment of the appropriate fee, and graduates and students of other universities, on payment of the appropriate fee, and at the discretion of the University Librarian, may have limited borrowing privileges. The University participates in Ontario and Quebec Inter-University borrowing arrangements which allow students in good standing to borrow directly from other Ontario and Quebec universities.

If books are not returned to the Library when due, fines and billing costs will be charged.

The book collection is protected from theft by an electronic detection system, and as a condition of use of the Library facilities all users must, if requested to do so, submit books, briefcases, bags, etc., for inspection at the exit.

Placement and Career Counselling

The Placement and Career Counselling Service is provided by the Department of Manpower and Immigration and is located in Room 508, University Centre (telephone 231-2600).

The purpose of the service is two-fold:

- To provide students with readily available access to employment opportunities. To this end the Centre maintains lists of part-time, summer and regular employment opportunities. As well, each year the Centre arranges for a number of employers, both local and national,

to recruit on campus. The majority of these recruiting visits are for the purpose of interviewing graduates and prospective graduates for permanent employment. Information concerning this program is posted early in the academic year, as the recruiting season commences the first week of November, usually terminating in late February or early March.

- To provide students with information about and assistance in preparing for entry into the labour market. Individual and group counselling, covering such topics as labour market trends, specific careers, job hunting and résumé preparation, is available to students seeking or preparing for employment. Also, the Centre maintains a library of up-to-date literature of interest to these students.

All Placement and Career Counselling information may be obtained by contacting the Centre or referring to the notices posted throughout the University. The University papers and radio stations are additional sources of information from the Centre.

Student Government

Carleton University Students' Association

All registered students, full- and part-time, are members of the Students' Association. The Students' Association has two main functions — providing services to students and representing their views on a wide range of interests both internally and externally.

The legislative body for the Students' Association is Students' Council. Elected representatives from each faculty serve for 12 months with the one graduate representative elected by the Graduate Students' Association in October. The Students' Council President, Finance Commissioner and undergraduate representatives are elected in the spring and the rest of the executive is appointed by the President and subject to Council's approval shortly thereafter.

The Students' Association provides a variety of services including a pub, coffee house, Box Office and Information Carleton. The Charlatan is the campus newspaper published by the Joint Board, a CUSA-Charlatan management committee.

CUSA holds the licenses on an FM radio station, CKCU - Radio Carleton. The station broadcasts on 93.1 and is heard all over the National Capital Region and in points of Eastern Ontario.

Each year, new services are offered dependent on the orientation of the current Students' Council.

A major part of the Student's Association is the University Centre, run by the Association for the whole University community; policy is set by the Students' Council. The University Centre houses the following facilities: food services, lounges, main hall, meeting-dining rooms, variety store, table tennis and billiards tables. Students' Council offices, Faculty Club, arts and crafts workshop, reading rooms, variety store, table tennis and billiards tables, health services, Canada Manpower Office, etc. It is open from 7:30 a.m. to 2:00 a.m. most days.

Students' interests are represented by the Association's membership in the Ontario Federation of Students and the National Union of Students. On campus the Students' Council each year tackles a number of issues which have ranged from university government to reviewing athletics to the financing of post-secondary education. CUSA has two researchers in its employ who staff the Education Office. These individuals are able to provide students with complete information concerning academic concerns and provincial and federal policy changes.

The Students' Association offices are located in Room 401 of the University Centre and may be reached by phone at 231-4380.

The Graduate Students' Association

The Graduate Students' Association comprises all students registered in a program of graduate studies at the University. Funds derived through a contractual agreement with the Carleton University Students' Association support the activities of the Graduate Association. These include a bi-weekly newsletter, a lounge open from 12 noon until 11 p.m. Monday through Friday, and financial support for departmental activities through a system of departmental grants.

The aim of these programs is to provide opportunities for graduate students to *communicate* with each other, and with the entire University community about issues and problems of particular concern to graduate students.

There are three elective executive positions (president, internal and external vice-presidents) and an elected council consisting of representatives from each graduate department. In addition, there is one graduate representative on the Students' Council. Elections generally take place in the fall term, during mid-October.

The current executive welcomes the interest and assistance of all graduate students.

Student Participation in Academic Affairs

New University Government (N.U.G.) is a governing system wherein all faculty members and some students are formally involved in the government of the University at the departmental, faculty board and Senate levels.

The first level is election to the faculty and departmental boards through a general election among all the graduate students in the various departments. From here it is theoretically possible to get support from a majority of faculty and get elected to Senate. As this has happened only twice, the Students' Association is investigating the possibility of direct election by students to these bodies.

General Information

Awards Policy

In recent years Carleton graduate students have won a large number of external scholarships, such as Canada Council fellowships and N.R.C. and Ontario government scholarships. In addition, the University itself provides generous support and the majority of graduate students receive funds from this source. Scholarships-cum-assistantships vary from $2,400 to $7,000 per annum. Students are expected to participate in the activities of departments by accepting responsibilities either as teaching or research assistants, or demonstrators. These activities are part of the learning experience, but at the same time provide training which is useful in seeking employment after completion of the degree.

Holders of awards must pay regular tuition fees unless otherwise stated.

Full-time graduate students at Carleton are expected to comply with the following procedures:

- Any full-time graduate student who accepts an award that is not directly administered by Carleton University must immediately inform his departmental chairman and the Dean of Graduate Studies and Research in writing. This requirement applies to any awards or assistance offered by any other agency or institution.
- Any full-time graduate student who accepts part-time employment outside the University is required to inform his departmental chairman and the Dean of Graduate Studies and Research, in writing, prior to undertaking the work.

Application Deadlines

March 15 is the last date for receipt of completed applications for admission (including transcripts, letters of reference, etc.) from candidates who wish to be considered for the initial award, announced April 1, of financial assistance administered by Carleton University.

Candidates whose applications are received after the March 15 deadline may be eligible by reversion for the award of a scholarship-cum-assistantship by reversion. These are normally considered on or about May 15, August 15, and October 1.

Methods of Payment

Scholarships-cum-assistantships administered by Carleton University will be paid on a monthly basis, with the first installment on *October 1.*

Students are urged to note the above payment dates and be prepared to be financially self-sufficient during the month of September.

Other Awards

A number of national and provincial organizations award fellowships and scholarships that are tenable at Carleton University (for example, the Canada Council, the National Research Council, etc.) Some application procedures and regulations concerning fellowships awarded by agencies other than Carleton University are given in the description of each of these awards.

In addition, a large number of foundations, companies, fraternal organizations, and other agencies offer fellowships and scholarships. A listing of these awards along with details of deadlines and application procedures has been compiled and may be consulted in the Graduate Studies and Research Office.

Eligibility

In the case of fellowships, grants, scholarships, etc., for which students must make application, it is the individual student's responsibility to establish his eligibility. Should it become known that a student is unqualified for any reason, he must return the funds already received, with the University assuming no responsibility.

Departments recommending students for internal awards must accept full responsibility for the eligibility of their nominees.

Students are urged to consult carefully the brochures and announcements which specify the conditions associated with tenure of individual awards. This information is available in the Graduate Studies and Research Office and in the office of the chairman of the department concerned. An up-to-date listing of awards is published in the weekly Carleton University newspaper, *This Week at Carleton.*

Awards Administered by Carleton University

The awards administered by Carleton University are derived from a variety of sources. Throughout the years a number of individuals and organizations, both formally and informally, have contributed substantial funds to the University through bequests and donations in order to help support students in various fields of study.

It is not always possible to identify precisely the sources of various donations and bequests (often small but most important in the aggregate) from which any graduate student's financial support has been constructed. These sums, together with the assistantship funds made available from the University budget, make up the reservoir from which the Carleton scholarships-cum-assistantships are drawn.

In some cases, however, either because of the relative importance of the contribution or because of the fact that it is earmarked for a specific type of student or program, we do identify the external source from which the award administered by Carleton University has originated:

The David and Rachel Epstein Foundation Scholarships

Part of the income from the David and Rachel Epstein Foundation Fund has been designated to provide scholarships, established in 1970, for outstanding graduate students at Carleton University.

They may be held in combination with a teaching or research assistantship. Application is not required; recipients are to be chosen from the list of candidates recommended by each department.

John Ruptash Memorial Fellowship

This fellowship was established in 1974 by relatives, former students, faculty colleagues and friends as a memorial to the late John Ruptash who was Dean of Engineering and later Dean of Graduate Studies between 1959 and 1973. The fellowship has been awarded annually, beginning in 1975-76, to an outstanding graduate student in the Faculty of Engineering.

The Fellowship may be held in combination with a teaching or research assistantship from the Faculty of Engineering. Application is not required; the recipient will be chosen by the Awards Committee from candidates recommended by the Faculty of Engineering.

Paterson Fellowships

From the generous support provided by the Honorable Norman M. Paterson when the School was established in 1966, funds are allocated to support some candidates for the M.A. degree in the Norman Paterson School of International Affairs.

All those with high standing who are admitted to this program are considered for these fellowships.

TIME Canada Graduate Scholarship in Journalism

Established in 1974, this Scholarship, which carries a value of $1,000, will be granted annually on the basis of academic and professional excellence to a student entering the Master's program in journalism.

Application is not required; the recipient will be chosen from a list of candidates recommended by the School of Journalism.

I.O.D.E. Eva Leadley Clark Award

Through the sponsorship of the Amelia F. Sims Chapter, I.O.D.E., a scholarship derived from a legacy by the late Eva Leadley Clark is offered annually to a student entering the Master of Journalism program.

The scholarship, valued at $1,000, will be awarded on the basis of academic standing and need.

Hudson's Bay Graduate Fellowships in Canadian Studies

Two graduate fellowships, valued at $1,500, will be awarded annually by the Hudson's Bay Company to outstanding students entering a Master's degree program in the Institute of Canadian Studies. The sum of $1,200 will be awarded directly to the student and the balance will go to the Institute.

Application is not required; the recipients will be chosen from a list of candidates recommended by the Institute of Canadian Studies.

Fred Barkley Special Bursary

This bursary, in the amount of $500, is awarded annually to a graduate student from a developing country who requires special financial assistance in order to study at Carleton University. The recipient of the award will be announced by the Dean of Graduate Studies and Research in September each year.

R.O. MacFarlane Memorial Book Award

This award is presented annually to an outstanding student registered in a graduate program in the School of Public Administration at Carleton University. Endowed in 1971 by relatives, friends and graduates of Carleton University, the award is named in honour of the late R. Oliver MacFarlane, first director of the School of Public Administration, 1953-71.

Residence Fellowships

Residence fellowships for men and women, providing free accommodation and meals for one academic year, are available to students of Carleton University.

Applications are invited from graduate and senior undergraduate students with good academic standing.

Application forms may be obtained from the Student Housing and Food Services Office, Carleton University, Ottawa, Ontario K1S 5B6. Completed applications should be returned to the same address.

Graduate Bursaries

A full-time graduate student who experiences *unexpected* financial need, after completion of five weeks from the date of most recent registration, may be awarded a bursary of up to $200 for that term (with a maximum of $500 for three consecutive terms). Application forms are available from departments and from the Graduate Studies and Research Office.

Awards Tenable at Carleton University

Canada Council Doctoral Fellowships

The Canada Council offers fellowships ranging in value up to $6,000 for students in the first two years of their program, and up to $7,000 for students who have completed the first two years of their program, for studies and research at the doctoral level in the humanities and social sciences.

These fellowships are tenable in Canada or abroad for a maximum of 12 months and may be renewed upon application.

Application forms and brochures containing details of the assistance programs available may be obtained from the Graduate Studies and Research Office or from the chairman of the department concerned, or by writing to the Canada Council, P.O. Box 1047, Ottawa, Ontario. Applications must be submitted to the Council by December 1.

Canada Council Special M.A. Scholarships and The Queen's Fellowships

To be eligible for these awards, a student must be nominated by a faculty member of a Canadian university and be in his/her final year of an Honours B.A. program or its equivalent at a Canadian university, or hold an Honours B.A. degree or its equivalent from a Canadian university and not yet have started a Master's program. Nominees must be Canadian citizens, have first-class standing in their present program or previous programs, and intend to pursue full-time graduate studies at a Canadian university.

The value of the award is $6,000, plus travel allowance for the award holder only, and it is tenable for 12 months. The Queen's Fellowships also include tuition fees. Nominations must be submitted on a nomination letter provided by the Regional Chairman; the closing date for nominations from faculty members is October 1.

Central Mortgage and Housing Corporation Scholarships

The Central Mortgage and Housing Corporation offers graduate scholarships for full-time study in various fields related to housing and the housing environment. The program is divided into two competitions: benefits from the *University Scholarship Competition* include tuition, initial travel expenses of the student from place

of residence to place of study, an allowance of $900 for each dependent child, and a personal allowance of $5,100. The student may apply for renewal up to three times; applications should be submitted through the Graduate Studies and Research Office no later than March 15.

The Open Scholarship Competition consists of $3,000 for each four-month module of full-time study. Up to three modules may be taken, for a total period of 12 months of full-time study and for the full award of $9,000. Applications for the open competition should be submitted directly to CMHC no later than March 15.

Commonwealth Scholarships and Fellowships

The Government of Canada, through the Commonwealth Scholarships and Fellowships Committee, offers annually a number of scholarships and fellowships, normally awarded for two years, which cover such expenses as travelling costs, tuition fees, other university fees, and a living allowance, to students of other Commonwealth countries.

Under a plan drawn up at a conference held in Oxford in 1959, these Commonwealth Scholarships and Fellowships are awarded mainly for graduate study, and are tenable in the country making the offer.

Students are advised to consult the Graduate Studies and Research Office for details of the terms of the awards offered by Canada and other countries, or to write to the Association of Universities and Colleges of Canada, 151 Slater Street, Ottawa, Ontario K1P 5N1.

Persons intending to apply for the year 1979-80 are advised to inquire not later than mid-October, approximately one year prior to the date of tenure.

National Research Council Postgraduate Scholarships

National Research Council Postgraduate Scholarships ($6,000 for 12 months, plus travel) are tenable at Carleton University by students undertaking advanced studies and research in science, engineering, experimental psychology, and physical geography.

Students currently enrolled at Carleton University must apply through their departments on or before November 7 on prescribed forms available from the Graduate Studies and Research Office. Others must submit applications by December 1.

1967 Science Scholarships

The National Research Council annually offers scholarships valued at $7,500 (plus travel, if required). Nominations (including supporting documents) must be sent to the Graduate Studies and Research Office by November 7.

These awards are tenable only at Canadian universities other than those from which the recipients have graduated. Further details of these awards may be obtained from the Graduate Studies and Research Office or from the chairman of the department concerned.

Ontario Graduate Scholarships

The Province of Ontario annually offers scholarships of $1,500 per term to applicants with a high level of academic achievement (first-class standing in most courses) who intend to pursue graduate studies at an Ontario university. These awards are not available to students in a qualifying or "make-up" year.

Completed application forms must be submitted through the Graduate Studies and Research Office no later than December 1.

The Queen Elizabeth II Ontario Scholarships

The Queen Elizabeth II Ontario Scholarship Fund provides a number of annual awards, valued at $7,000 each, for graduate study and research leading to the Ph.D. degree in the humanities, social sciences, and mathematics.

The scholarships are tenable only at Ontario universities, and preference will be given to candidates who are residents of Ontario.

Further details of the terms of these awards may be obtained from the Graduate Studies and Research Office.

Prescribed application forms are to be completed and submitted to the Dean of the Faculty of Graduate Studies and Research on or before December 1. Nominations made through the Dean will be forwarded to the Selection Committee by December 15.

Sir John A. Macdonald Graduate Fellowship in Canadian History

The Province of Ontario annually offers the Sir John A. Macdonald Graduate Fellowship, valued at $6,000, for full-time graduate studies and research in the field of Canadian history at the Ph.D. level. The fellowship is tenable for three years, at an Ontario university only, and it will be awarded to a Canadian citizen resident in Ontario.

Application forms and additional information can be obtained from the Graduate Studies and Research Office. The deadline date for submission of completed applications to the Dean of Graduate Studies and Research is February 13.

Department of National Defence Scholarships and Fellowships

The Department of National Defence annually offers scholarships valued at $4,500 plus fees, and fellowships valued at $7,000 plus fees, return economy air fare for the Fellow and his immediate family, and a supplementary award of $1,500 for married fellows.

These awards are to support military and strategic studies of interest to Canada, including work on the national and international aspects of security, studies of strategic theory, alliances and the United Nations, and civil-military relations.

Applicants must be Canadian citizens. Candidates for the scholarships must hold an Honours bachelor's degree or its equivalent and candidates for the fellowships must have a Ph.D. degree or equivalent level of knowledge or experience in the field. Both awards are available for one year, with the possibility of renewal.

Application forms and additional information may be obtained from the Director of Awards, Association of Universities and Colleges of Canada, 151 Slater Street, Ottawa, Ontario K1P 5N1. The closing date for receipt of completed applications is December 15.

Transportation Development Agency Fellowships in Transportation

The Transportation Development Agency awards a number of fellowships valued at $4,200 - $6,500 for 12 months plus tuition fees of up to $700, (Master's and Ph.D. levels), for full-time graduate study in any discipline related to transportation.

Applicants must be Canadian citizens or landed immigrants in Canada before January 1. The awards are tenable at any Canadian university but in special circumstances doctoral awards may be approved for tenure outside of Canada.

Application forms may be obtained from the Graduate Studies and Research Office or directly from the Transportation Development Agency. Applications must be submitted to the University by the candidates before December 31. Completed applications, postmarked no later than January 13, will be forwarded to the Transportation Development Agency by the Dean of Graduate Studies and Research.

Bell Canada Fellowships

Bell Canada awards eight $5,000 fellowships annually, covering a 12-month period, for students who are proceeding towards a Master's degree. Applicants must be Canadian citizens or have held landed immigrant status for 12 months prior to submitting applications; they must also have been residents of Ontario, Quebec, or the parts of the Northwest Territories served by Bell Canada, for 12 consecutive months immediately prior to submitting their applications.

Further information and application forms are available through the Awards Officer, National Programs Division, Association of Universities and Colleges of Canada, 151 Slater Street, Ottawa, Ontario. Deadline is March 1.

Gulf Oil Canada Limited Graduate Fellowships

Gulf Oil Canada Limited annually offers nine fellowships, valued at $5,500 ($4,500 payable to the fellow, and $1,000 to be placed at the disposal of the department in which he is registered), for graduate study and research in a field of study related to the pretroleum industry.

The fellowships, which may be renewed, are open to Canadian citizens or persons holding landed immigrant status one year prior to application who are graduates of Canadian universities or colleges which are members or

affiliates of the Association of Universities and Colleges of Canada. The awards are tenable only at universities in this category.

Application forms and further details may be obtained by writing to the Director of Awards, Association of Universities and Colleges of Canada, 151 Slater Street, Ottawa, Ontario K1P 5N1.

Applications must be submitted by March 1.

Shell Canada Graduate Fellowship in Geology

Shell Canada provides annually a postgraduate fellowship valued at $3,750, ($3,000 to the student and $750 to the department) for graduate study and research. The award may be held for three years with consideration being given to a fourth year if necessary.

The recipient is chosen by the Awards Committee following nomination by the Department of Geology.

Imperial Oil Graduate Research Fellowships

Imperial Oil Limited offers annually six fellowships, up to the value of $4,000 per year for a maximum of three academic years, for study and research leading to the Ph.D. degree in pure and applied sciences, the social sciences, or the humanities.

The fellowships are open to any Canadian citizen who is a graduate, or prospective graduate in the year of competition, of any approved university.

Nomination forms, which must be received by Imperial Oil Limited not later than February 1, are available from the Graduate Studies and Research Office.

I.O.D.E. War Memorial Scholarships

Ten scholarships are offered annually by The Imperial Order Daughters of the Empire for postgradaute study and research in the humanities or social sciences. The awards are valued at $5,000 for study in Britain or another country in the Commonwealth and $3,000 for study in a Canadian university.

Candidates must be Canadian citizens and graduates of recognized colleges or universities.

Additional information and application forms may be obtained by writing to the I.O.D.E., Educational Secretary for the Province of Ontario, 168 Jackson Street West, Hamilton, Ontario. The closing date for applications is November 15.

J.H. Stewart Reid Memorial Fellowship

This Fellowship provides an award of $3,000 for 12 months for any field of study in a graduate program in any Canadian university. It is open to students who are Canadian citizens or who have held landed immigrant status from February 1, 1978 and have been admitted to a Canadian graduate program by the time of award. Applications, due February 1, may be obtained from the Awards Officer, Canadian Association of University Teachers, 66 Lisgar Street, Ottawa, Ontario K2P 0C1.

Resources for the Future Incorporated

The RFF Inc. offers annual doctoral dissertation fellowships of $4,500 to assist qualified graduate students in completing doctoral dissertation work in the field of natural resources, and to stimulate their interest in the application of social science disciplines to problems in the field of natural resources. Candidates must be nominated by the academic department in which they are doctoral candidates. Direct applications are not accepted.

Nominees must have completed all requirements for the doctorate except the dissertation before the beginning of the 1978-79 academic year. Research must relate to natural resources, their products or services, and must involve the social sciences or related fields of study. Nominations must be received by February 1. Further details are available from the Graduate Studies and Research Office or Resources for the Future, Inc., Fellowship Program, 1755 Massachusetts Ave., N.W., Washington, D.C. 20036.

Canadian Advertising Advisory Board

Doctoral fellowships of up to $4,000 are available for any approved research project in the economic and social aspects of advertising. These fellowships are open to any Canadian citizen or anyone residing in Canada working towards a doctoral degree. Candidates are expected to be at or near the dissertation stage.

Applications, due before March 31, should be made to the Director of Awards, Canadian Advertising Advisory Board, 159 Bay Street, Toronto, Ontario.

Canadian Department of Labour — University Research Program

Grants ranging up to $5,000 a year are provided for research studies in the field of labour relations and labour economics. Applications are accepted from graduate students and university faculty members, provided they are Canadian citizens or can demonstrate they will be residing in Canada on a continuing basis. Further information and application forms are available from the Secretary, Department of Labour — University Research Committee, Economics and Research Branch, Canada Department of Labour, Ottawa, Ontario K1A 0J2. Applications must be received by February 15.

Canadian Wildlife Service Scholarships

The Canadian Wildlife Service offers Canadian citizens postgraduate scholarships tenable at Canadian universities during 1978-79. These scholarships, valued at $1,200, are available to students enrolled in a program in an aspect of terrestrial wildlife biology. Applications are available in the Graduate Studies and Research Office. Deadline is June 1.

Awards for Research and Study in Mental Retardation

The National Institute on Mental Retardation offers two awards to students entering or pursuing graduate studies: Type A offers up to $6,000 plus a travel/training award for a one-year period; Type B offers supplementary funding to cover costs of a graduate program. The awards are tenable in a wide area of study, and are not limited to fields directly associated with mental retardation. The deadline for applications for Type A is February 20, and for Type B, April 14.

Franki Fellowship

This fellowship is offered to a graduate student in science, engineering or agriculture at a Canadian university to further the advancement of the science of soil mechanics in Canada; it carries a value of $2,500 for the student and $500 for the directing professor. The university is responsible for the choice of candidates and must inform Franki Canada Limited in writing before April 15. Further information may be obtained from Franki Canada Limited, 1320 Graham Boulevard, Montreal, Quebec H3P 2C4.

Grants and Loans

Ontario Student Assistance Program

All students who are residents of Ontario, Canadian citizens or landed immigrants, and who satisfy the admission requirements of a Canadian university or an eligible post-secondary institution in Ontario may apply for an award under this program.

To receive an award, a student must establish a need for assistance and enroll in an eligible institution in the year of the award. An award under this program will be made to the extent of established need in a combination of a non-repayable grant and a Canada Student Loan.

Application forms are available from the Awards Office at Carleton. Deadline date for applications is July 1 for replies prior to fall registration.

Canada Student Loans Plan

Students who do not qualify for financial assistance under the Ontario Student Assistance Program may apply for a Canada Student Loan.

Application forms and a brochure containing details of the plan, including conditions of eligibility, may be obtained from the Awards Office at Carleton University.

Departmental Program Descriptions and Details of Courses

Faculty of Arts

Dean: James Downey

Department of Art History

The Department

Chairman of the Department: C.M. Brown
Departmental Supervisor of Graduate Studies: Peter Larisey

The Department of Art History offers two courses at the graduate level, under the aegis of the Institute of Canadian Studies.

Graduate Courses*

• Art History 11.505T2
Selected Aspects of Canadian Art History
A tutorial to study specific areas of Canadian art in the Pre-Confederation and Post-Confederation periods.
Prerequisite: Honours courses in Art History or permission of the Departmental chairman.
Departmental coordinator and members of the Curatorial Staff, National Gallery of Canada.

• Art History 11.506F1, W1, S1
Directed Reading and Research
Tutorials designed to permit advanced students to pursue topics in Canadian art which they have selected in consultation with the staff.
Prerequisite: Permission of Departmental chairman and the Institute of Canadian Studies.
Departmental coordinator and members of the Curatorial Staff, National Gallery of Canada.

• Art History 11.507F1
Selected Aspects of Contemporary Inuit Art
This seminar is designed to study the problems of Inuit artists and their art in contemporary Canadian society in relation to acculturation, identity crisis and cultural self-affirmation.

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

Institute of Canadian Studies

The Institute

Director of the Institute: Davidson Dunton
Visiting Fellow: David Lewis
General Editor, Carleton Library:
Michael Gnarowski

The Institute of Canadian Studies offers programs of study and research leading to the degree of Master of Arts in Canadian Studies.

Through the medium of the Institute, the following departments cooperate in offering the programs:
Art History, Economics, English, French, Geography, History, Journalism, Law, Linguistics, Music, Political Science, Psychology, and Sociology/Anthropology.

The Canadian Studies program is interdisciplinary in emphasis. It enables students in the Institute to develop individual programs to meet particular interests in a broad range of Canadian issues.

Among special areas in which it is possible to build individual programs are: *communications; regional studies; urban studies; French-Canadian studies; native peoples; Canadian art history and music; and studies in Canadian literature.*

The proximity of Carleton University to the National Library, the Library of Parliament, the Public Archives of Canada, Statistics Canada, and the libraries of various government departments and embassies, ensures excellent research facilities for graduate candidates in Canadian Studies.

The Institute of Canadian Studies sponsors and gives editorial supervision to the Carleton Library, a series of paperback reprints and compilations of classic material relating to Canadian history, law, economics, politics, anthropology, sociology, geography and journalism. There are 109 volumes to date.

A new series, Carleton Contemporaries, launched in 1968, consists of original monographs and compilations focusing on the issues of the day—political, social, economic and cultural.

Further information may be obtained by writing directly to the Institute.

Qualifying Year Program

Applicants with general (pass) Bachelor's degrees with high second-class standing, will be required to complete successfully a Qualifying Year of study before proceeding to the Master's program.

Refer to the general section of this Calendar for the regulations governing the Qualifying Year.

Master of Arts

Admission Requirements

Applicants must normally hold an Honours B.A. (or the equivalent), with at least high second-class standing, in one of the disciplines represented in the Institute.

A reading knowledge of French is a prerequisite for admission.

Program Requirements

The minimum requirements for the Master's program are outlined in the general section of this Calendar. The Institute of Canadian Studies specifies that all candidates must select one of the following program patterns:

- three full courses or the equivalent, a thesis, and an oral comprehensive examination;
- four full courses or the equivalent, a research essay, and an oral comprehensive examination.

Graduate Courses*

- Canadian Studies 12.500T2
Modern Concepts of Canada
Interdisciplinary seminar.
Davidson Dunton.

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

• Canadian Studies 12.590T2, S2
Directed Studies
Reading and research tutorials.

• Canadian Studies 12.591F1, W1, S1
Directed Studies
Reading and research tutorials.

• Canadian Studies 12.598F2, W2, S2
Research Essay

• Canadian Studies 12.599F4, W4, S4
M.A. Thesis

Selection of Courses

In addition to the graduate courses offered by the Institute, the following courses are open to students in Canadian Studies. Master's students in the Institute must complete at least four courses or the equivalent at the 500 level, with the possibility of one course at the 400 level. The list is subject to change.

Anthropology
54.475 Contemporary Problems in Anthropology: The North, Canada
54.516 North American Ethnography
54.587 Selected Topics: Anthropology of Canadian Politics

Art History
11.300 Canadian Painting
11.305 Canadian Architecture
11.407 Prehistoric Art of the Canadian Arctic
11.408 Contemporary Inuit Art in the Context of Art History
11.490 Directed Studies
11.505 Selected Aspects of Canadian Art History
11.506 Directed Reading and Research
11.507 Selected Aspects of Contemporary Inuit Art

Economics
43.325 The Economic Development of Canada
43.330 Social Economics
43.340 Problems of Area Development
43.357 Introduction to Industrial Relations
43.380 Topics in Canadian Economic Policy
43.400 Labour Economics
43.465 Industrial Relations
43.480 Urban Economics
43.511 The Canadian Economy
43.512 Workshop on the Canadian Economy
43.530 Industrial Organization
43.540 Public Finance
43.580 Urban Analysis
43.581 Regional Analysis

English
18.381 Studies in Canadian Poetry
18.383 Studies in Canadian Fiction
18.387 Selected Topic in Canadian Literature
18.483 Seminar in Canadian Fiction
18.487 Special Topic in Canadian Literature
18.581 Canadian Poetry
18.583 Canadian Fiction
18.588 Studies in Canadian Literature

French
20.381 Aspects de la littérature canadienne française
20.464 Aspects de la littérature (B)
20.520 L'évolution de l'image de la femme dans l'écriture féminine du Canada français

Geography
45.305 Geography of Canada
45.320 Urban Geography
45.333 Land Use, Regional Development and Planning in Canada
45.334 Renewable Resource Planning in a Local Area
45.340 Advanced Economic Geography
45.351 Geography of the Northlands
45.421 Selected Themes in Urban Geography
45.442 Transportation Geography
45.540 Explorations in Cultural-Historical and Political Geography
45.570 Problems of Development in Arctic and Subarctic Environments
45.571 Selected Studies in the Human Geography of Arctic and Subarctic Lands
45.572 Problems in Canadian Resource Development
45.579 Research and Development in Recreational Geography

History
24.325 See Economics 43.325
24.330 Social History of Canada

24.331 French Canada since Confederation
24.332 The Maritime Provinces, 1750-1900
24.334 Canada-United States Relations
24.336 Canadian External Relations
24.337 The Emergence of the Political Tradition in Canada
24.431 French Colonial Society
24.432 Seminar on Acadian History
24.433 Selected Problems in the Social and Political Development of Twentieth-Century Canada
24.435 Confederation
24.532 Studies in the Economic and Social History of Upper Canada and Ontario, 1815-1880
24.534 Problems of Growth and War in Canada, 1896-1921
24.535 Canada in the North Atlantic World, 1900-1939
24.537 The Maritimes in Transition, 1840's to 1890's
24.570 Problems in Imperial History with Particular Reference to British North America
24.588 Historiography: Canada

Journalism
28.301 Media Research
28.351 See Law 51.351
28.352 See Law 51.352
28.434 Media and Society I
28.435 Media and Society II
28.461 Perspectives on Modern Society
28.462 Public Issues in Canada
28.521 Journalism Research
28.522 Journalism Research
28.530 Mass Media/Mass Society
28.532 Press and Government

Law
51.301 Women and the Legal Process
51.351 Communications Law I
51.352 Communications Law II
51.353 Civil Liberties and Human Rights
51.354 Law and Native Peoples of Canada
51.374 Local Government Law
51.380 Law of Environmental Quality
51.387 Quebec Law
51.450 Canadian Constitutional Law
51.455 Administrative Law I
51.491 Tutorial in Law
51.492 Tutorial in Law
51.550 The Canadian Constitution
51.553 Advanced Legal Problems of Federalism

Music
30.310 Music in Canada, 1600-1900
30.311 Canadian Music in the Twentieth Century
30.315 Ethnomusicology
30.510 History of Canadian Music I
30.511 History of Canadian Music II
30.512 History of Canadian Music III

Political Science
47.300 Provincial Government and Politics
47.301 Canadian Intergovernmental Relations
47.302 Canadian Municipal Government
47.303 Canadian Urban Politics
47.304 Political Parties and Elections in Canada
47.335 Canadian Political Ideas
47.336 Canadian Political Culture and Ideologies
47.340 Canadian Public Administration
47.366 Canadian Foreign Policy
47.400 Topics in Canadian Government and Politics
47.401 Policy Making in Canada
47.402 Problems in Northern Development
47.403 Politics and the Media
47.404 Interest Groups in Canadian Politics
47.405 Federalism
47.406 Legislative Process in Canada
47.409 French-Canadian Politics
47.500 Canadian Local Government and Politics
47.501 Canadian Provincial Government and Politics
47.506 Problems of Canadian Government and Politics: I
47.507 Problems of Canadian Government and Politics: II
47.508 The Politics of Energy and the Environment
47.510 The Political Process in Canada
47.520 Nationalism
47.535 The Canadian and American Political Traditions
47.540 Analysis of Canadian Public Policy and Administration
47.561 Canadian Foreign Policy

Psychology
49.590 Directed Study

Sociology
53.320 French-Canadian Society
53.345 Stratification and Mobility
53.400 Sociological Analysis
53.525 Canadian Society
53.545 Power and Stratification

Department of Classics

The Department

Chairman of the Department: D.G. Beer
Departmental Supervisor of Graduate Studies: R.C. Blockley

The Department of Classics offers programs of study leading to the degree of Master of Arts. The following three program categories are available:

- Classics
- Greek only
- Latin only

Qualifying Year

Applicants who hold a general (pass) B.A. degree will normally be required to complete successfully a Qualifying Year program before proceeding to the Master's program. Refer to the general section of this Calendar for the regulations governing a Qualifying Year.

Program Requirements

The Qualifying Year program will correspond quite closely to the final year of the Honours undergraduate program offered by the Department of Classics, although it may include graduate courses.

Master of Arts

Admission Requirements

The minimum requirement for admission to the Master's program is an Honours B.A. degree in classical civilization, ancient history, classics, Latin, or Greek.

Program Requirements

The regulations governing program requirements are outlined in the general section of this Calendar. Master's students will normally be required to complete three full courses (or the equivalent) at the 500 level, and a thesis equivalent to two full courses.

The Department also specifies the following:

- Students entering the program with a degree in classical civilization must have a knowledge of Latin or Greek to the level of 16.100 or 15.100 (or the equivalent) and the other of the two languages to the level of 16.015 or 15.015 (or the equivalent). In special circumstances, the Department will allow a student to enter the Master's program with less than these requirements, but in that case, the student will have to reach the necessary standard before graduation.
- Students taking the degree in Greek only must have credit in Senior Matriculation Latin or an approved equivalent; those in Latin only must have credit in Greek 15.015 (or the equivalent).
- All students must demonstrate a knowledge of German. Credit in German 22.015, or an approved equivalent, will be accepted.

Graduate Courses*

- Classics 14.505F1
Introduction to Linguistics
- Classics 14.506W1
Elementary Textual Criticism
- Classics 14.520T2
A Greek Author
- Classics 14.521T2
A Latin Author
- Classics 14.530T2
A Greek Literary Genre
- Classics 14.531T2
A Latin Literary Genre
- Classics 14.550T2
A Greek Historical Period
- Classics 14.551T2
A Roman Historical Period

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

- Classics 14.552T2
A Topic in Greek and Roman History

- Classics 14.599F4, W4, S4
M.A. Thesis

Comparative Literature Committee

The Committee

Chairman of the Committee: C.A. Marsden

The Comparative Literature Committee offers programs of graduate study leading to the degree of Master of Arts.

The purpose of the comparative literature program is to study literature in its international context, and to relate and compare literary phenomena usually studied in isolation because of linguistic barriers and the traditional departmental division of academic disciplines. Thus, taking into account the interrelation of all humanistic studies such as the various literatures, philosophy, psychology, sociology, the visual arts and history, "comparatists" view literary creation within the total complex evolution of world literature. The historical flow of literary archetypes, the role of folklore and myth in literature, recurrent problems of literary theory and consideration of the less well-known literatures of the world are some of the objects of comparative literature studies.

The study of this discipline must be based on a truly comparative perspective, on a solid linguistic foundation and on an awareness of all difficulties that arise in comparative literature conceived as a domain both within and beyond limits of national literatures.

Students registered in other language departments, who wish to register in one or more courses from the comparative literature program, must demonstrate a reading knowledge of the languages required for each course. Three years of study at the university level will normally constitute the required level of language proficiency.

Qualifying Year Program

Applicants who hold only a general (pass) B.A. degree will be required to complete successfully any two of the following four basic qualifying courses while pursuing their special interests in the field:

- Comparative Literature 17.410
Critical Approaches to Literature I: Linguistic Stylistics
- Comparative Literature 17.420
Critical Approaches to Literature II: Historical and Aesthetic
- Comparative Literature 17.430
Critical Approaches to Literature III: Psychological Criticism
- Comparative Literature 17.440
Critical Approaches to Literature IV: Sociology of Literature

The total course program is to be worked out in consultation with the graduate studies supervisor. Formal admission to the Master's program may be considered at the end of the first term.

Master of Arts

Admission Requirements

The regulations governing admission to the Master's program are outlined in the general section of this Calendar.

The specific requirements for admission to the Master's program in comparative literature are the following:

- An Honours B.A. degree (or the equivalent) with at least second-class standing, including two full courses in literature at the senior undergraduate level in each of the two language fields (studied in the original language); candidates who hold degrees in only one national literature will be required to take additional courses or to register in the Qualifying Year program.
- In addition to proficiency in English, students must have a comprehensive knowledge of either French or German (including the ability to read primary and secondary sources in that language and to participate occasionally in class discussions in that language).
- A reading knowledge of at least one additional language from among the following: French, German, Spanish, Italian, Russian, Latin or classical Greek; in special cases the Committee may permit the substitution of some other language. Three years of study at the university level will normally constitute the required level of language proficiency. The Committee reserves the right to test proficiency and reading knowledge by examination.

Program Requirements

The program requirements for Master's candidates in comparative literature are the following:

- Comparative Literature 17.501
Theory of Literature and Standard Problems in Comparative Literature;
- The two basic full courses listed above in the Qualifying Year program; students who have already taken one or more of these courses (or the equivalent) will substitute other appropriate comparative literature courses (not including 17.593, 17.594 and 17.595).
- one of the following:
Comparative Literature 17.599
M.A. Thesis; or two additional courses in comparative literature (not including 17.593, 17.594 and 17.595).
- a final comprehensive examination (written and oral).

In all cases the Committee will prescribe a program of studies that will complement the student's background and special interest.

Graduate Courses*

A prerequisite for all graduate-level courses is appropriate linguistic ability and approval of the Comparative Literature Committee.

- Comparative Literature 17.410T2
Critical Approaches to Literature I: Linguistic Stylistics
This course deals with poetics and the descriptive analysis of literary texts according to recent development in linguistic stylistics. Practical work includes application of semiotics and principles of narrative grammar to literary texts.
H.-G. Ruprecht.

- Comparative Literature 17.420T2
Critical Approaches to Literature II: Historical and Aesthetic
An examination of the concept of periods, movements, trends and the various factors which may help to stimulate literary creation ("source", "influence", "convention", "tradition", etc.). The changing values, standards and tastes implicit in each new period or phase of literature are related to the aesthetic approach which analyzes the problems in the description, interpretation and evaluation in the light of contemporary aesthetics.
C.A. Marsden and J.M. Thompson.

- Comparative Literature 17.430T2
Critical Approaches to Literature III: Psychological Criticism
A method of analysis based on Mauron, Laplanche, Ricoeur, Lacan and others, as well as Freud's interpretation of artistic phenomena, applied to the poetry of such writers as Brecht, Auden, Aragon, Neruda, etc.
Prerequisite: French and preferably German or Spanish and permission of the instructor.

- Comparative Literature 17.440T2
Critical Approaches to Literature IV: Sociology of Literature
Topic: Cultural Analysis of the Modern Short Story
This course will examine the problem of communication through fiction. Analytical models will be developed by comparison and mapping of the structures of discourse, decoding of meanings, and assessment of their impact on culture. Works to be studied will be selected from those most publicized during the "Turn of the Century".
Prerequisite: Preferably French and one other relevant language and permission of the instructor.
Stéphane Sarkany.

- Comparative Literature 17.501T2
Theory of Literature and Standard Problems
Topic: Aspects of European, Anglo- and Hispano-American Modernity
Comparative studies in late nineteenth- and twentieth-century drama, novel and poetry centered upon the question "what was/is 'modern' literature?" with textual analysis

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

in the light of contemporary literary theories. This includes problems such as periodization of international movements, investigation of cultural codes in relationship to formal devices, modes of reception and concretization and figures of intertextuality, etc.
H.-G. Ruprecht.

• Comparative Literature 17.506T2
Periods
Topic: Courtly Love in Medieval Literature
An examination of the phenomenon of Courtly Love through the study of romances and poems of European literature of the Middle Ages. Translations will be used as required.
Prerequisite: Two relevant European languages in addition to English (sufficient for reading original mediaeval texts) and permission of the instructor.
G.A. Woods.

• Comparative Literature 17.507T2
Study of a Theme or Motif
Topic: Utopia and Literature
An examination of the idea of Utopia as a literary myth in the world of fiction (de-emphasizing though not ignoring philosophical, political or social content). Readings will range from Plato to Skinner and will include related concepts of The Earthly Paradise, The Golden Age, The Imaginary Voyage, Science Fiction.
Prerequisites: Two relevant languages other than English and permission of the instructor.
C.A. Marsden.

• Comparative Literature 17.530T2
Literary Archetypes
Topic: The Modern Ulysses: The Myth of the Return in the Twentieth-Century Novel
A study of the relationship between myth and narrative structures in the light of recent narratological theories, as well as other literary and socio-cultural aspects of the topic. Texts of Joyce, Wolfe, Silone, Pirandello, etc.
Prerequisite: Preferably Italian and French and permission of the instructor.
F.G. Loriggio.

• Comparative Literature 17.561T2
Studies in Literary Genres
Topic: Modern Drama
A survey of major dramatists and the themes and theatrical traditions which they represent, from Ibsen and Strindberg to the present. (Also offered as English 18.564)
Prerequisite: Reading knowledge of two appropriate languages other than English and permission of the instructor.
Gordon Wood.

• Comparative Literature 17.590S1
Seminar in Comparative Literature

• Comparative Literature 17.591T2
Seminar in Comparative Literature
Topic: Conceptions and Structures of "Poetic Memory" in Romantic, Post-Romantic and Modern Literature
An examination of poetological thought and literary works from the early nineteenth century to the present with respect to modes of (re) creative remembering. This will lead to a semiotic understanding of "mémoire poétique". Comparative studies on selected texts by French, English, German, Italian and Spanish writers with special emphasis on contemporary Hispano-American and French-Canadian poetry.
Prerequisite: Reading knowledge of either French, German, Italian or Spanish and permission of the instructor.
H.-G. Ruprecht.

• Comparative Literature 17.592T2
Seminar in Comparative Literature
Topic: The Ideological Analysis of Discourse
The history of the concept "ideology" documented in French (for example, Condillac), German (for example, Marx, Engels, etc.), English (Candwell, etc.), and Italian (Gramsci) theoretical works and its application to the interpretation of poetic literature and the analysis of "literary" language as well as "popular" prose (for example, comic strips).
Prerequisite: Two relevant languages other than English and permission of the instructor.
Pierre Laurette.

• Comparative Literature 17.593F1, W1, S1
Selected Readings
This course is designed specifically to assist students in the preparation for their comprehensive examinations.

• Comparative Literature 17.597F1, W1, S1
Directed Special Studies
From time to time, students whose main interests are not covered by courses offered in a given year, may pursue independent research subject to the availability of a qualified adviser and relevant library resources at Carleton. Interested students should apply directly to the supervisor of graduate studies.

• Comparative Literature 17.598T2
Directed Special Studies
(Same description as 17.597)

• Comparative Literature 17.599F4, W4, S4
M.A. Thesis

Courses Not Offered in 1978-79

17.505 Translation Workshop
17.525 Literary Movements in the Nineteenth and Twentieth Centuries

The attention of students is drawn to courses of a comparable nature in other Departments which might complement or reinforce their interests, such as Art History 11.480 and 11.484, Secular and Religious Iconography, or Spanish 38.560, The Spanish-American Short Story.

Department of English Language and Literature

The Department

Chairman of the Department: James Steele
Departmental Supervisor of Graduate Studies: R.G. Laird

The Department of English offers programs of study leading to the M.A. degree in English language and literature. Additional information may be obtained by consulting the Departmental supervisor of graduate studies.

Qualifying Year Program

Applicants who hold a general (pass) B.A. degree with at least B- standing, with a major in English language and literature, may be admitted to the Qualifying Year program. Normally, these students will be required to complete four or five full courses (or the equivalent) in English as determined by the Department and to maintain at least a B- average in the Qualifying Year courses, before being considered for admission into the Master's program.

Master of Arts

Admission Requirements

The minimum admission requirement for the Master's program is an Honours B.A. (or the equivalent) in English language and literature, with at least a B- average and including at least five of the following areas:

- History of the English Language or General English Linguistics
- Old English or Middle English
- Renaissance Literature
- Drama (including Shakespeare)
- Restoration and Eighteenth-Century Literature
- Romantic and Nineteenth-Century Literature
- Twentieth-Century Literature
- Canadian Literature

Possession of the minimum entrance standing is not in itself, however, an assurance of admission into the program.

Program Requirements

Each candidate will select one of the following optional program patterns:

- Three full courses (or the equivalent) in English, including English 18.597 (Special Topic Studies), selected from those offered at the 500 level (except 18.598) and a Master's thesis; an oral examination on the thesis and related fields will also be undertaken.
- Five full courses (or the equivalent) in English, including English 18.598 (Directed Special Studies), selected from those offered at the 500 level (except 18.597).

Under certain conditions, one of the optional courses in either program pattern may be selected from those offered by the Department at the senior undergraduate level in a field for which no graduate course is available. One of the optional courses may also be a cognate course at the graduate or the senior undergraduate level offered by another department. However, not more than one undergraduate course may be included in the total program.

All candidates are required to demonstrate a reading knowledge of one language other than English, approved by the Department.

Academic Standing

A standing of B- or better must be obtained in each course counted towards the Master's degree.

Graduate Courses*

- English 18.500T2
Literary Criticism
In 1978-79, a study of four major twentieth-century critics: T.S. Eliot, Cleanth Brooks, Northrop Frye, and Lucien Goldmann.
T.H. Coulson, V.K. Chari, R.H. MacDonald and Stéphane Sarkany.

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

• English 18.531F1
Renaissance Poetry
A study of the Metaphysical poets, particularly the work of their leader and greatest writer, John Donne. Other poets read will include Herbert, Marvell, and perhaps Vaughan and Carew.
Patrick Cruttwell.

• English 18.536W1
Renaissance Literature
A study of Shakespeare's tragedies and their literary background.
L.A. Mann.

• English 18.538T2
Renaissance Studies
This seminar will analyze closely important sections of Milton's *Paradise Lost* for their elucidation of the plan announced in the invocation, together with examination of relevant prose works in translation.
D.J. Wurtele.

• English 18.542S1
Eighteenth-Century Prose and Poetry
In 1978, a study of the novels of Jane Austen in relation to eighteenth-century society and thought.
R.B. Lovejoy.

• English 18.548T2
Studies in Romanticism
In 1978-79, the work of Wordsworth and Coleridge will be examined for the influence it exhibits of various eighteenth-century themes and literary traditions.
A.W. Heidemann.

• English 18.553T2
Nineteenth-Century Fiction
A study of the major works of several selected nineteenth-century novelists.
R.R. Rutland.

• English 18.561T2
Twentieth-Century Poetry
In 1978-79, a study of the works of Eliot, Stevens and Williams, with particular reference to their conceptions of poetry.
A.T. Tolley.

• English 18.563T2
Twentieth-Century Fiction
Starting from detailed discussion of major novels and critical and biographical works by Virginia Woolf and E.M. Forster, the course will attempt to define these writers' relation to the Bloomsbury ethos.
Christopher Levenson.

• English 18.564T2
Twentieth-Century Drama
A survey of major dramatists and the themes and theatrical traditions which they represent, from Ibsen and Strindberg to the present.
G.J. Wood.

• English 18.566W1
Twentieth-Century Literature
In 1978-79, a study of the art of fiction as exemplified in Henry James's theory and practice. Major writings from all phases of his career will be considered.
A.M. Beattie.

• English 18.567F1
Selected Twentieth-Century Authors
In 1978-79, a study of the work of James Joyce in short story, drama, poem and novel, concentrating on *A Portrait of the Artist as a Young Man* and *Ulysses*.
T.H. Coulson.

• English 18.576S1
American Literature
Studies in American fiction of the Romantic period: the tales and novels of Poe and Hawthorne.
L.D. Young

• English 18.581T2
Canadian Poetry
Duncan Campbell Scott: a study of the man, his poetry, and its relation to poetry in Canada from 1867 to 1945. There will be substantial use of original documents.
R.L. McDougall.

• English 18.583S2
Canadian Fiction
In 1978, the use of social realism in the works of Morley Callaghan and in Robertson Davies' first triology will be contrasted to the use of myth in Cohen, Ondaatje, Kroetsch, and Davies'

second triology.
L.T.R. McDonald.

• English 18.583T2
Canadian Fiction
In 1978-79, the course will concentrate on selected writings of Thomas Haliburton, Stephen Leacock and Robertson Davies.
M.J. Edwards.

• English 18.588T2
Studies in Canadian Literature
The development of literary criticism in English Canada, beginning with early nineteenth-century critics and including such modern authors as Frye, McLuhan, Atwood, Pacey, Klinck and Woodcock.
R.D. Mathews.

• English 18.597T2, S2
Special Topic Studies
All thesis students will be assigned to an adviser (normally their thesis supervisor) for special tutorials in the general area of their thesis research. There also will be a series of lectures on bibliography and research methods.

• English 18.598T2, S2
Directed Special Studies
All students in the M.A. course program will be assigned to an adviser who will direct their area of Special Studies, preparing them for an oral examination in that area.

• English 18.599F4, W4, S4
M.A. Thesis

Generally, all members of the Department are available for advising in 18.597, 18.598, and 18.599.

Courses Not Offered in 1978-79

18.518 Old Norse
18.521 Middle-English Poetry
18.522 Middle English
18.527 Selected Medieval Authors
18.528 Middle-English Studies
18.532 Seventeenth-Century Prose and Poetry
18.534 Renaissance Drama
18.537 Selected Renaissance Authors
18.543 The Eighteenth-Century Novel
18.551 Nineteenth-Century Poetry
18.568 Twentieth-Century Studies
18.571 American Poetry
18.573 American Fiction
18.578 Studies in American Fiction
18.590 Selected Topic
18.594 Special Studies in Dramatic Literature

The Department

Chairman of the Department: D.W. Smith
Departmental Supervisor of Graduate Studies: Albert Halsall

The Department of French offers a program of studies leading to the degree of Master of Arts in French language and literature.

Qualifying Year Program

Applicants who hold a general (pass) Bachelor's degree with second-class standing or higher, with a major in French will be required to register in the Qualifying Year program (normally five courses in French chosen from those numbered at the 400 level), and maintain at least B- standing in each of these courses, before proceeding to the M.A. program.

Master of Arts

Admission Requirements

The normal requirement for admission into the Master's program is an Honours B.A. in French with second-class standing.

Program Requirements

Master's candidates normally are required to enroll in five full courses (or the equivalent), of which at least four must be chosen from those numbered at the 500 level.

The following course patterns are available:

- five full courses;
- four full courses and a research essay (20.590: Etudes dirigées) equivalent to one full course;
- three full courses and a thesis (20.599) equivalent to two full courses.

All Master's students must undertake a comprehensive examination (written and oral). The written part will consist of questions based on a reading list of approximately six texts, and the oral section will consist of a series of general questions. The syllabus for this examination will be distributed in December, and it will be undertaken in either May or September.

With the approval of the Department, Master's students in French may select a comparative literature course in partial fulfillment of their program requirements.

Academic Standing

A grade of at least B- must be obtained in each course counted for credit towards the Master's degree.

Selection of Courses

The following senior undergraduate courses are open to students in the Qualifying Year program and, with the approval of the Department, to students in the M.A. program:

French

20.431 Traduction littéraire
20.432 Morphologie et syntaxe du français
20.434 Stylistique littéraire
20.435 Linguistique appliquée: pédagogie de l'enseignement du français
20.461 Mouvement des idées et littérature au 19e siècle, au Canada français
20.463 La Pléiade: théorie et pratique

In the summer session 1978 a course at the 400 level will be offered; the topic to be announced.

Graduate Courses*

The graduate courses offered by the Department are open to students in the M.A. program and, with permission of the Department, to students in the Qualifying Year program. For prerequisites, please consult the Department.

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

• French 20.520T2
Aspects de la littérature canadienne-française
L'image de la femme dans l'écriture féminine au Canada français. Les thèmes, images et mythes récurrents de la littérature féminine à la lumière de l'histoire et de la psychologie. Le rôle de la femme sera étudié dans le contexte du nationalisme et du jansénisme, et son évolution sera tracée à partir du XIXe siècle.
Patricia Smart.

• French 20.545T2
Aspects de la littérature du XIXe siècle
La poésie française à la fin du XIXe siècle. Perspectives sociales et psychanalytiques. Mallarmé et Valéry. Perspectives sociales: analyse des conditions de production littéraire de l'époque. La dialectique des codes littéraires dans le champ socio-culturel. Perspectives psychanalytiques: le réel (psychanalytique), l'imaginaire et le symbolique dans l'oeuvre littéraire.
Pierre Laurette.

• French 20.550T2
Aspects de la littérature du XXe siècle
Transformations du discours romanesque. Analyse des changements subis par les éléments du discours romanesque (voix et visions, discours et récit, pacte narratif, temporalité et spatialité, etc.) à mesure qu'ils passent du roman dit "traditionnel" au roman dit "existentialiste", "métaphysique", "philosophique", et aussi au "Nouveau" roman, au "Nouveau nouveau" roman, etc.
Eugenia Zimmerman.

• French 20.570T2
Séminaire sur l'oeuvre d'un écrivain
Gide et l'art de la fiction. Analyse des techniques fictives de Gide pour révéler les aspects poétiques et rhétoriques des quatre sous-genres narratifs qu'il a pratiqués: la fiction symboliste, les récits, les soties, le roman. Techniques à traiter: le monologue intérieur, le style indirect libre, l'emploi ironique du journal intime, le fonctionnement des personnages porte-parole, la mise en abîme, etc.
Albert Halsall.

• French 20.585T2
Séminaire sur un problème d'histoire littéraire
L'autobiographie en France du XVIIIe au XXe siècle. L'étude de l'autobiographie dans ses rapports avec les autres genres narratifs (mémoires, journal intime, roman personnel). La situation de l'auteur par rapport au narrateur et au personnage principal. Fonctions littéraires de l'autobiographie dans l'oeuvre de Rousseau, Chateaubriand, Stendhal, Gide et Sartre.
Eldon Kaye.

• French 20.590T2
Etudes dirigées

• French 20.591S1
Etudes dirigées
Preparation for the comprehensive examination.

• French 20.599F4, W4, S4
M.A. Thesis

In the summer session 1978 a course at the 500 level will be offered; the topic to be announced.

Courses Not Offered in 1978-79

20.433 Sémantique et lexicologie du français
20.466/7 Littérature et sciences humaines
20.481 Littératures francophones
20.482 Initiation à la recherche
20.501 Aspects de la linguistique
20.525 Aspects de la littérature médiévale
20.530 Aspects de la littérature de la Renaissance
20.535 Aspects de la littérature du XVIIe siècle
20.540 Aspects de la littérature du XVIIIe siècle

Department of German

The Department

Chairman of the Department: Basil Mogridge
Departmental Supervisor of Graduate Studies: J.B. Dallett

The Department of German offers programs of study leading to the degree of Master of Arts. These include courses on all major periods in German literature, genres, themes and a number of individual authors, as well as on aspects of literary theory and the study of the German language. The Age of Goethe figures prominently in the teaching and research of the Department, which offers a favourable setting for specialized studies in this period.

Departmental requirements conform to those outlined for Master's students in the general section of this Calendar. Further information concerning graduate work in German can be obtained from the Department.

Program Requirements

Master's students in German normally will be required to select and follow one of the following optional program patterns:

- three full courses (or the equivalent) and a thesis;
- four full courses (or the equivalent) and a research essay;
- five full courses, or the equivalent.

German 22.590 is an obligatory course for all graduate students (full course credit).

All Master's students are also required to undertake a comprehensive examination, based on a Departmental reading list.

Selection of Courses

The following senior undergraduate courses are open, with the approval of the Department, to students in the M.A. program. Students in the Qualifying Year program may take additional undergraduate courses.

German

22.430 Medieval Language and Literature
22.450 Goethe
22.471 The Short Story
22.490 Tutorial
22.491 Tutorial

For 400-level courses not offered in 1978-79 see the *Thirty-seventh Annual Undergraduate Calendar.*

Graduate Courses*

- German 22.545F1
Genres in German Literature
Elemente des Prosastils im 20. Jahrhundert: R.M. Rilke, A. Döblin, G. Grass, R. Kunze.
Jutta Goheen.

- German 22.560F1
Period Studies
From private sentiment to courtly gallantry in the German baroque novel. Pastoral, bourgeois, and heroic strains in seventeenth-century fiction: Zesen, Thomas, Grimmelshausen, and Ziegler und Kliphausen.
J.B. Dallett.

- German 22.573W1
Individual Authors
R.M. Rilke. A study of his poetry.
E.M. Oppenheimer.

- German 22.590T2
Directed Studies
An obligatory course of supervised study in preparation for the comprehensive examination.

- German 22.591F1, W1
Special Topic
Tutorial.

- German 22.598F2, W2, S2
Research Essay

- German 22.599F4, W4, S4
M.A. Thesis

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

Courses Not Offered in 1978-79

22.530 Literary Theory: Mimesis, Poiesis, and Politics
22.531 Literary Theory: Poetry and Science
22.541 Genres in German Literature: Struktur des modernen Romans
22.542 Genres in German Literature: Austrian Drama
22.544 Genres in German Literature: The German Idyll from Gessner to Mörike
22.550 Prevalent Themes in German Literature: Myth in Drama
22.551 Prevalent Themes in German Literature: Citizen, Bourgeois, Philistine
22.561 Period Studies: Madness and Hallucination in German Romanticism
22.562 Period Studies: Community in Fiction: Bobrowski and V.S. Naipaul
22.563 Period Studies: Mittelalterliches Erzählen
22.564 Period Studies: Gabriele Wohmann and Franz Josef Degenhardt
22.570 Individual Authors: C.M. Wieland
22.572 Individual Authors: Heinrich von Kleist
22.574 Individual Authors: Goethe's Early Dramas
22.580 Linguistic Problems

The Department

Chairman of the Department: J.W. Strong
Departmental Supervisor of Graduate Studies: R.T. Clippingdale
Associate Supervisor (supervising non-Canadian M.A. program): R.C. Elwood

The Department of History offers programs of study and research leading to the degrees of Master of Arts and Doctor of Philosophy.

Master of Arts

Admission Requirements

The minimum requirement for admission to the Master's program is an Honours bachelor's degree (or the equivalent) with at least second-class standing.

The Department offers no Qualifying Year program; applicants with a general (pass) degree may be considered for admission into the fourth year of Carleton's Honours B.A. program.

Program Requirements in Canadian History

Candidates may follow either a thesis or non-thesis program, as follows:

- History 24.588
a seminar in the historiography of Canada;
- History 24.590
preparation for a written M.A. field examination (two full course credits);
- Either History 24.599
thesis and participation in appropriate seminar; *or*
two additional graduate seminars, one of which may be an approved seminar in a related field.

Program Requirements in Other Fields

The Department offers M.A. work in fields other than Canadian history for which there are adequate resources in Ottawa.

Candidates may follow either a thesis or non-thesis program, as follows:

Thesis program

- History 24.588
directed studies in the historiography of the student's major field of concentration, leading to a final oral examination (one credit);
- History 24.599
thesis (two full credits);
- a research seminar in the student's major field of concentration (one credit);
- one other seminar
(*not* a research seminar) in another field (possibly outside the Department and possibly at the 400 level) (one credit);

Non-thesis program

- History 24.588
as above (one credit);
- a research seminar in the student's major field of concentration (one credit);
- another research seminar (one credit);
- History 24.598
a research essay in the student's major field of concentration (one credit);
- one other seminar (*not* a research seminar) as above (one credit).

Language Requirements

All candidates are required to demonstrate a reading knowledge of a language other than English, the choice to depend upon the field of the candidate's thesis or research. For each research seminar dealing with sources not in English, a reading knowledge of the appropriate langauge will be required *before* registration in the seminar will be permitted. For details, contact R.C. Elwood.

Doctor of Philosophy

Admission Requirements

Applicants with an M.A. degree will be expected to have at least high second-class standing. Applicants with an Honours B.A. with first-class standing may be admitted directly into the Ph.D. program.

Residence Requirements

- a minimum of three years of full-time study after the B.A. Honours degree or two years after the M.A.

Program Requirements

Candidates will be responsible for three fields, one of which will be related to the subject of thesis research and one of which may be in a related discipline. The fields will normally be selected from Canadian history, American history, modern British history and an aspect of modern European history. Each field will cover approximately one century.

There will be written examinations in the two non-thesis fields and one oral comprehensive examination covering all three. These will be taken normally within four terms following the beginning of the first Ph.D. year.

A reading knowledge of French will be required. The language examination will be written early in the first post-M.A. year and before the candidate is permitted to take the doctoral fields examination. Proven competence in an additional language may be required if it is pertinent to the candidate's program.

Students entering the program with an Honours B.A. will normally take History 24.588: Historiography of North America; History 24.591: Tutorial in a major field; History 24.592: Tutorial in a selected field; and two other graduate seminars in their first year.

Students entering the second year (that is, the first post-M.A. year) will be required to follow:

- History 24.688
Social History;
- History 24.690
preparation for a general oral Ph.D. examination (equivalent to two full credits).
- Two of
History 24.610: directed studies in an aspect of modern European history; History 26.640: directed studies in United States history; History 24.650: directed studies in British history; an approved course of studies in a related discipline appropriate to the candidate's field. Candidates may take an appropriate 500-level seminar.

In the final year of the Ph.D. program, candidates will be required to write a thesis on a topic related to Canadian history.

University of Ottawa

A Carleton student may take one research seminar with the Department of History at the University of Ottawa, with permission of the two departments. Research seminars available in 1978-79 are:

- Directed Studies in Canadian History: Post-Confederation Intellectual History
- Etudes dirigées en histoire du Canada: Histoire intellectuelle (après Confédération)
- Rapports intellectuels du Canada français avec l'extérieur au XIXe siècle
- Lower Canada 1760-1840 (in English)
- Directed Studies in European History: Nineteenth-Century French History
- Etudes dirigées en histoire européenne; histoire socio-culturelle, la France du XIXe siècle
- United States Foreign Relations in Nineteenth and Twentieth Centuries (half-course)
- Problèmes en histoire sociale de Nouvelle France

Graduate Courses*

- History 24.505T2
Studies in Medieval English Common Law
J.G. Bellamy.

- History 24.516T2
The French Revolution, 1788-1804
A sound reading knowledge of French is required for admission.
M.J. Sydenham.

- History 24.532T2
Studies in the Economic and Social History of Upper Canada and Ontario, 1815-1880
J.K. Johnson.

- History 24.534T2
Problems of Growth and War in Canada, 1896-1921
M.J. Barber and R.T. Clippingdale.

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

• History 24.535T2
Canada in the North Atlantic World, 1900-1939
An examination of Canada's changing relationships with Great Britain and the United States at the opening of the twentieth century.
D.M.L. Farr.

• History 24.537T2
The Maritimes in Transition, 1840's to 1890's
A seminar on social and economic themes. Quantitative approaches and comparative themes with Central and Western Canada will be encouraged.
D.A. Muise.

• History 24.557T2
Community in Early Modern England, 1450-1600
R.B. Goheen.

• History 24.560T2
Late Imperial and Revolutionary Russia, 1855-1921
A sound reading knowledge of Russian is required for admission.
R.C. Elwood.

• History 24.570T2
A Seminar in British Imperial History
Research will normally be done on a British North American or Canadian subject considered in an Imperial context between the late eighteenth and early twentieth centuries.
G.P. Browne.

• History 24.588T2
Historiography
A seminar or course of directed studies comprising one of the following fields:

Canada
A course, primarily for graduate students in Canadian history, to examine the trends and methods of Canadian historical writing and the influences upon it.
S.R. Mealing.

Britain
The intensive study of a range of selected problems in the writing of sixteenth-century English history.
Directed studies.
R.B. Goheen.

Modern France
The intensive study of selected problems in the writing of modern French political and social history.
Directed studies.
M.J. Sydenham and E.P. Fitzgerald.

Modern Russia
Concentrated reading in Russian intellectual history and supervised study of Russian historiography, with emphasis on the nineteenth century. Reading knowledge of Russian is required.
Directed studies.
R.C. Elwood and John Strong.

Medieval History
Historical method and historiography of the Middle Ages.
Directed studies.
J.G. Bellamy.

• History 24.590T4, S4
Supervised study in a specified field, in preparation for a written M.A. field examination in Canadian history (equivalent to two full courses).
Directed studies.

• History 24.591T2
Directed Studies in a Canadian Field
Directed studies for Ph.D. candidates in an area of Canadian history appropriate to the candidate's program.

• History 24.592T2
Directed Studies in a Related Field
Directed studies for Ph.D. candidates in a field other than Canadian history appropriate to the candidate's program.

• History 24.598F2, W2, S2
Research Essay (non-Canadian fields only)

• History 24.599F4, W4, S4
M.A. Thesis
A substantial historical investigation. The subject will be determined in consultation with the Department and a supervisor will be assigned. The candidate will be examined orally after presenting his thesis.

• History 24.610T2
Directed studies in one of the following aspects

of modern European history: Modern France (M.J. Sydenham and E.P. Fitzgerald) and Modern Russia (R.C. Elwood and John Strong).

• History 24.640T2
Directed Studies in United States History
P.J. King and E.R. Kantowicz.

• History 24.650T2
Directed Studies in British History
J.N. Cooper.

Courses of study in a related discipline which are appropriate to a student's program may be approved by the Department.

• History 24.688T2
Social History
A course, primarily for graduate students in history, in which the literature and methodology of basic aspects of social history will be examined.
J.N. Cooper and others.

• History 24.690T4, S4
Directed Studies
Directed study in preparation for a general oral Ph.D. examination.

• History 24.699F, W, S
Ph.D. Thesis

Courses Not Offered in 1978-79

24.536 Canada Between the Wars, 1919-1939
24.540 The Growth of American Consciousness (From the Great Awakening to the Mexican War)
24.558 Reform and Society in Mid-Nineteenth-Century Britain
24.580 Problems in International History: Theory and Dissent about Foreign Policy, 1900-1941
24.588 United States (Historiography)

The School

Director of the School: G.S. Adam
Departmental Supervisor of Graduate Studies: R.J. Rupert

The School of Journalism offers courses leading to the degree of Master of Journalism. The emphasis in the M.J. program is on advanced professional education for those who are or intend to become practising journalists in the news media, but there is provision for students who wish to undertake research in journalism and mass media.

Students who wish to complete a non-professional degree in either media and society and/or journalism research are advised to consult with the Institute of Canadian Studies; it is possible to work out an M.A. program in these areas under the joint supervision of the Institute and the School of Journalism.

Students entering the Master's program will choose one of four areas of concentrated study:

Specialized Reporting
Courses provide advanced training in specialized news beats in journalism such as politics, the economy or international affairs.

Specialized Media
The focus of this specialty will be techniques of television, radio and documentary film. Students will be expected to work to standards of professional competence.

Media and Society
This specialty encompasses a number of topics among which are the law of the press, journalism history, government-press relations, issues in contemporary journalism such as those raised by the ownership and control of publishing and broadcasting in Canada, and an examination of the role of the media in society as it is conceived by selected social and political theorists.

Journalism Research
This will focus on the theories and methods, mainly quantitative, of research into the communication processes with emphasis upon journalism and news media systems.

Carleton's School of Journalism is uniquely situated for advanced journalism study. It offers ready access to many of the people and institutions that most directly influence Canadian affairs: Parliament, federal government departments and agencies, embassies, business and labor organizations and major economic and cultural institutions are close at hand.

Qualifying Year Program

Applicants who have three-year (pass) journalism degrees with high second-class standing may be admitted to a Qualifying Year program made up largely of courses from the Faculty of Arts. An applicant with a background in another discipline who does not have a journalism degree or the equivalent may be admitted to a Qualifying Year of basic professional studies if he or she achieved at least a B average in the previous degree.

Students who complete a Qualifying Year program with high second-class honours may proceed with Master's level studies the following year.

For details of the regulations governing Qualifying Year programs, refer to the general section of this Calendar.

Master of Journalism

Admission Requirements

Admission to the M.J. program is selective. The basic requirement is an Honours B.J. degree with at least second-class standing or its equivalent. Students also are required to have at least four months practical experience in the media and a working knowledge of a second language, preferably French.

The program of studies to be undertaken must be consistent with the applicant's undergraduate background or professional experience.

Graduate Courses*

Students are required to complete successfully five full courses or the equivalent. They will have their work evaluated at the end of each academic term and those working below a B– level normally will be asked to withdraw.

In 1978-79 most courses will be prescribed and students will be required to take:

• Journalism 28.530F1
Mass Media/Mass Society
Theories used in the analysis of the relationship between mass media and mass societies will be examined.
J.R. Weston.

• Journalism 28.532W1
Press and Government
A critical examination of the press in the political systems of Britain, the United States and Canada. The course will include a research component.
G.S. Adam.

• Journalism 28.540T2
Specialized Reporting
A series of seminar-workshops on approaches and problems in one area of reporting, such as politics, labour, science or finance. (Certain of these specialties may not be offered every year.)
Anthony Westell.

• Journalism 28.599F4, W4, S4
M.A. Thesis
The student will complete either a substantial piece of public affairs work in journalism in any medium or a research project on the mass media.

The courses described above constitute four of the required five credits. Students will choose from among the following options to complete their course requirements:

• Journalism 28.521F1
Journalism Research
A laboratory course in design and analysis of mass media research. Under direction, students will undertake all phases of a research project from conceptualization of the problem through reporting findings.
J.R. Weston.

• Journalism 28.522W1
Journalism Research
A seminar course dealing in depth with selected methodological and theoretical issues in media research.
J.R. Weston.

• Journalism 28.588F1
Directed Readings
Students, working under faculty direction, will undertake an intensive reading schedule in order to pursue a subject area of particular interest.

• Journalism 28.589W1
Directed Research
Students, working under faculty direction, will develop and undertake a research project in order to pursue a subject area of particular interest.

With the approval of the School and the participating department, M.J. students may take two half-courses in either political science or economics.

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

Department of Linguistics

The Department

Chairman of the Department: William Cowan

The Department of Linguistics does not offer a program of studies at the graduate level, but does offer opportunity for independent study to students in the Institute of Canadian Studies in the areas of linguistic study of the Cree, Iroquois and Inuit languages, Canadian English and Canadian French dialectology, and the teaching of English as a second language. Members of the Department are also prepared to supervise graduate theses on linguistic subjects.

In cooperation with the Faculty of Graduate Studies and Research, the Department publishes the papers of the annual Algonquian Conference.

Graduate Courses*

• Linguistics 29.590F1, W1, S1
Native Languages of Canada
A tutorial to study the descriptive, historical and anthropological aspects of selected native languages of Canada, among them Cree, Iroquois and Inuit.
Prerequisite: Honours courses in linguistics or permission of the chairman.

• Linguistics 29.591F1, W1, S1
Sociolinguistic Aspects of Bilingualism
A tutorial to study the linguistic aspects of French-English bilingualism, including sociolinguistic and psycholinguistic factors.
Prerequisite: Honours courses in linguistics or permission of the chairman.

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

Department of Music

The Department

Chairman of the Department: Alan Gillmor

The Department of Music offers a course in the history of Canadian music and related fields at the graduate level in cooperation with the Institute of Canadian Studies. Full use will be made of the resources of the National Library, the Public Archives and the National Museum of Man.

Dr. Elaine Keillor is lecturer in Canadian music with Dr. Roxanne Carlisle, and Dr. Helmut Kallmann (Chief Music Librarian, National Library) as Adjunct Professors.

Graduate Courses*

• Music 30.510T2
History of Canadian Music I
Selected aspects of Canadian music from 1600 to the present; liturgical music; social and economic conditions of Canadian musical life; regional studies; individual composers.
Prerequisite: Permission of the instructor and the Institute of Canadian Studies.

• Music 30.511F1
History of Canadian Music II
Selected problems of folk music in Canada.
Prerequisite: Permission of the instructor and the Institute of Canadian Studies.

• Music 30.512W1
History of Canadian Music III
Selected problems in the music of Canadian ethnic minorities, especially Inuit and Indian traditions.
Prerequisite: Permission of the instructor and the Institute of Canadian Studies.

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

Department of Philosophy

The Department

Chairman of the Department: R.S. Talmage
Departmental Supervisor of Graduate Studies: Bernard Wand

The Department of Philosophy offers programs of study leading to the degree of Master of Arts.

Qualifying Year

Applicants who do not hold an Honours degree (or the equivalent) will be required to register in a Qualifying Year program before proceeding to the Master's program.

The regulations governing the Qualifying Year are outlined in the general section of this Calendar.

Master of Arts

Admission Requirements

Applicants for the Master's program must have an Honours degree (or the equivalent) in philosophy, with at least second-class standing.

Applicants for admission from an institution other than Carleton University must submit two papers.

Program Requirements

The specific program requirements for Master's candidates are the following:

- Philosophy 32.545, the Departmental seminar;
- a thesis equivalent to two full course credits, which must be defended at an oral examination; *or* a research essay equivalent to one full course credit;
- four half-course credits (or *six* in the case of students following the research essay option) in at least three of the following study areas: studies in the history of philosophy; studies in the work of an individual philosopher; studies in logic, epistemology, or metaphysics; studies in selected problems in philosophy.

In exceptional cases, a maximum of one full course (or the equivalent) may be selected from those offered at the 400 level or in a related field or at another university.

Academic Standing

A grade of B- or better must be obtained in each course and on the thesis or the research essay.

Selection of Courses

The following senior undergraduate courses are open to students in the Qualifying Year and, with permission, to students in the M.A. program.

Philosophy
32.406 Descartes
32.407 Hume
32.409 Marx
32.411 Action, Intention and Responsibility
32.416 Medieval Philosophy
32.421 Epistemology
32.441 Contemporary, Ethical and Political Philosophy
32.491 Tutorial

This list of courses may be changed slightly. Please consult Undergraduate Calendar listings.

Graduate Courses*

The following graduate courses are open to students in the M.A. program and, with permission, to students in the Qualifying Year program. Five two-hour tutorial sessions will be required in each half-course.

- Philosophy 32.504F1
Tutorial in the History of Philosophy I
Detailed study of a period or issue in the history of philosophy.

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter (or any other two terms) will be followed by 1

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

• Philosophy 32.505W1
Tutorial in the History of Philosophy II
Detailed study of a period or issue in the history of philosophy.

• Philosophy 32.514F1
Tutorial in the Work of an Individual Philosopher I
A critical and systematic study of the work of an individual philosopher.

• Philosophy 32.515W1
Tutorial in the Work of an Individual Philosopher II
A critical and systematic study of the work of an individual philosopher.

• Philosophy 32.524F1
Tutorial in Logic, Epistemology or Metaphysics I
An attempt to find a solution to a specific problem in logic, epistemology or metaphysics.

• Philosophy 32.525W1
Tutorial in Logic, Epistemology or Metaphysics II
An attempt to find a solution to a specific problem in logic, epistemology or metaphysics.

• Philosophy 32.534F1
Tutorial in Selected Problems of Philosophy I
An attempt to find a solution to a specific problem in some area, other than logic, epistemology or metaphysics.

• Philosophy 32.535W1
Tutorial in Selected Problems of Philosophy II
An attempt to find a solution to a specific problem in some area, other than logic, epistemology or metaphysics.

• Philosophy 32.545T2
Departmental Seminar
Research papers to be given by faculty members and students.

• Philosophy 32.598F2, W2, S2
Research Essay

• Philosophy 32.599F4, W4, S4
M.A. Thesis

The Department

Chairman of the Department: C.P. Slater
Departmental Supervisor of Graduate Studies: A.R. Gualtieri

The Department of Religion offers programs of study leading to the degree of Master of Arts.

Master of Arts

Admission Requirements

The minimum requirement for admission to the Master's program is an Honours bachelor's degree in religion (or the equivalent) with at least second-class standing.

Applicants who do not hold an Honours degree in religion (or the equivalent) will be required to register in a Qualifying Year program before proceeding to the Master's program.

The regulations governing the Qualifying Year are outlined in the general section of this Calendar.

Program Requirements

The student will choose a program of study concentrating on one of the following major areas: comparative religion, with special emphasis on one of the major traditions; biblical ancient near eastern studies; and modern religious thought and culture. The specific program requirements will be:

- seminars equivalent to one full course in major area;
- seminar equivalent to one full course, selected from one or both of the other areas;
- tutorial in major area for one course credit;
- thesis (equivalent to two full courses) on a topic in major area, which must be defended at an oral examination.

The student's program will be worked out in consultation with the Department's supervisor of graduate studies and its Committee on Graduate Studies. The prescribed program will take into account the student's background and special interests as well as the research interests and competence of the staff.

Language Requirements

The student will be required to acquire, or to demonstrate that he already has, a reading knowledge of whatever language is essential to his research.

Graduate Courses*

- Religion 34.510F1
Seminar in Comparative Religion: Western Interpretation of East Asian Traditions - Reappraisal
An examination of Western views on religious traditions in China and Japan, held by the Jesuit missionaries and by intellectuals in Europe, such as Pascal, Voltaire, Montesquieu and Leibniz, up to modern scholars.
David Chung.

- Religion 34.511W1
Seminar in Comparative Religion: The World of Islam in the Eyes of Al-Ghazali (d. 1111)
A study of one of the central scholars of Islam, dealing with his translated works. His numerous perspectives (legal, theological, philosophical, political and mystical) on Islam will be analyzed.
L.T. Librande.

- Religion 34.512T2
Tutorial in Comparative Religion

- Religion 34.520F1
Seminar in Biblical and Ancient Near Eastern Studies: A New Look at the Fourth Gospel
The seminar will consider the reversal of the trend in Johannine studies. In particular, a critique will be made of former German and British scholarship in the light of the most recent theories of provenance, dating and authorship.
R.E. Osborne.

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

• Religion 34.521W1
Seminar in Biblical and Ancient Near Eastern Studies
Jewish-Christian relations in the first two centuries C.E.
S.G. Wilson.

• Religion 34.522T2
Tutorial in Biblical and Ancient Near Eastern Studies

• Religion 34.530F1
Seminar in Modern Religious Thought and Culture: Augustine and His Modern Interpreters
The focus of the seminar will be on Augustine's *Confessions* and *City of God.*
C.P. Slater.

• Religion 34.531W1
Seminar in Modern Religious Thought and Cutlure: Meaning and Method - Introduction to the Work of Bernard Lonergan
The early work of this important Canadian thinker, *Insight*, is examined from the perspective of his recent contributions on methodology and human meaning, with focus on basic terms such as horizon, intentionality analysis, and transcendental method.
J.G. Ramisch.

• Religion 34.532T2
Tutorial in Modern Religious Thought and Culture

• Religion 34.550F1, W1
Directed Studies
Seminar for additional study in any one of the three major areas.

• Religion 34.599F4, W4, S4
M.A. Thesis

The Department

Chairman of the Department: Ross Larson
Departmental Supervisor of Graduate Studies: R.L. Jackson

The Department of Spanish offers a Master's program with specialization in either Peninsular or Spanish-American literature, or a combination of both.

All requests for more information concerning the program should be addressed to the Departmental supervisor of graduate studies. The Department will supply reading lists for individual courses and for the general comprehensive examination, and a brochure containing details of particular requirements and other information related to Spanish studies at Carleton.

Master of Arts

Admission Requirements

The requirements for admission to the Master's program are outlined in the general section of this Calendar.

Program Requirements

The minimum program requirements for Master's candidates are stated in the general section.

The Master's program may be undertaken in one of the following three optional patterns:

- three full courses (or the equivalent, not including 38.595), and a thesis equivalent to two full courses;
- four full courses (or the equivalent, not including 38.595), and a thesis equivalent to one full course;
- five full courses (or the equivalent, not including 38.595).

The Department of Spanish encourages candidates to select one of the thesis patterns.

The Department also requires all students to undertake general comprehensive examinations, and to complete a non-credit seminar on bibliography and research methods.

Students wishing to study aspects of Hispanic literature not specifically offered by the Department may enroll in Spanish 38.590: Directed Studies, if a specialist in the desired field is available.

All courses taken by graduate students shall be chosen in consultation with the Department. From time to time certain courses offered by other departments may be accepted as part of the Master's program in Spanish, and special arrangements can occasionally be made to undertake part of the program at universities in Spanish-speaking countries.

Selection of Courses

The following senior undergraduate courses are open to students in the Qualifying Year program, and with permission, to students in the M.A. program.

Spanish

38.402 Stylistics
38.415 Introduction to Medieval Literature
38.420 Cervantes
38.430 Modern Spanish Novel
38.435 Modern Spanish Theatre
38.440 Modern Spanish Poetry
38.450 Colonial Spanish-American Literature
38.460 Twentieth-Century Spanish-American Novel
38.470 Twentieth-Century Spanish-American Poetry
38.490 Seminar on a Special Topic
38.491 Special Studies

Graduate Courses*

- Spanish 38.505T2
History of the Spanish Language
José Jurado.

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

• Spanish 38.520F1, W1
Special Topic on Golden Age Literature
(520F1 Didactic Literature of the Golden Age)
A study of representative prose authors and movements of the period with special emphasis on Juan de Valdés, Fray Antonio de Guevara, Quevedo and Gracián.
J.M. López-Saiz.

(520W1 Spanish Mystic Literature)
Advanced and specialized study of themes, imagery, sources and influences in the works of selected Spanish Golden Age mystic writers (prose, drama and poetry).
Francisco Atienza.

• Spanish 38.530F1
Problems of Modern Spanish Literature: Rafael Alberti, Federico García Lorca and Surrealism
A structuralist approach to the poetry of Rafael Alberti and Federico García Lorca with special emphasis on the relationship of *Sobre los ángeles* and *Poeta en Nueva York* to the language of Surrealism.
Angel López-Fernández.

• Spanish 38.560T2
Aspects of Spanish-American Literature after 1888: The Spanish-American Novel since 1947
Analysis and interpretation of works by Asturias, Carpentier, Rulfo, Vargas Llosa, Fuentes, Cortázar, García Márquez and others.
Ross Larson.

• Spanish 38.570W1
Special Problems in Spanish-American Literature: The Concept of Irony in Twentieth-Century Spanish-American Literature
The course will study various theories of irony and analyze both its stylistic and thematic manifestations in a limited number of major twentieth-century Spanish-American writers. The works studied will include examples from poetry, prose fiction and theatre.
P.J. Roster.

• Spanish 38.590T2 or S2
Directed Studies

• Spanish 38.595F1, W1, S1
Directed Readings
Additional half-courses designed in particular for students needing special assistance in preparing for comprehensive examinations.

• Spanish 38.599F, W, S
M.A. Thesis

Courses Not Offered in 1978-79

38.515 Aspects of Medieval Literature
38.525 Studies in Eighteenth-Century Literature
38.550 Aspects of Spanish-American Literature before 1888

Departmental Program Descriptions and Details of Courses

Faculty of Engineering

Dean: M.C. de Malherbe

Engineering

Programs of study are offered by the Faculty of Engineering leading to the degrees of Master of Engineering and Doctor of Philosophy in aeronautical, civil, electrical and mechanical engineering, to the degree of Master of Engineering in materials engineering and, in co-operation with the Faculty of Science, to the degree of Master of Science in Information and Systems Science.

The areas of current research, the research facilities available and the graduate courses offered are given in the following pages for the four departments of the faculty:

- Civil Engineering
- Electronics
- Mechanical and Aeronautical Engineering
- Systems Engineering and Computing Science

Although each candidate will pursue his studies and research within one of these departments, he is encouraged to take at least one half-course outside his department. Both the Master's and Ph.D. programs may be undertaken on a full-time or part-time basis.

General information on awards and financial assistance is given in that section of this Calendar.

A limited number of students who are not degree candidates may be admitted to each graduate engineering course. Credit earned as a Special student normally cannot be counted towards the requirements of a graduate degree in engineering.

Computing Facilities

The University has a central system with comprehensive facilities including a large number of time-sharing terminals, remote job entry from the Mackenzie Building for batch, and a plotter and graphics. A large number of minicomputers including four with disc-operating systems and interactive graphics are in use by the various engineering departments.

Special Arrangements

Research in an Outside Institution

A student may apply for permission to carry out his research, in part or whole, in an outside institution (for example, industrial, governmental or university laboratory). Such an application, addressed to the Dean of Graduate Studies and Research through the Dean of Engineering, must:

- include a detailed statement of the research proposal, of arrangements for supervision and of the circumstances under which it is to be carried out;
- establish that the applicant will be able to pursue independent research;
- state the facilities available for the research;
- include a proposed time-schedule;
- be accompanied by a supporting letter from a responsible person in the outside institution giving approval of the proposal and accepting these regulations.

Part-time Thesis Research

A part-time research program may be permitted if the conditions for the "presence" of the student outlined under program requirements are satisfied. It is the responsibility of the research supervisor to define the fraction of full-time research engaged upon by the student so that this can appropriately be credited to his program and assessed for payment of tuition fees. Before permission to undertake research on a part-time basis can be granted, the student must submit in writing, to the Dean of Graduate Studies and Research through the Dean of Engineering, a statement of his proposed manner of working part-time, supported by a letter of approval from his employer.

Transfer of Credit

Normally credit for one full graduate course completed at another university may be accepted in partial fulfillment of degree requirements, provided that the course is appropriate to the candidate's program at Carleton. Under special circumstances a second full course may be allowed. Refer to the general section of this Calendar for details of the rules governing transfer of credit.

Master of Engineering

Admission Requirements

Applicants are admitted under the general regulations specified in this Calendar but in addition are required to have strong undergraduate preparation in the appropriate engineering disciplines, computer programming, mathematics and physics.

Program Requirements

Two alternatives are available for full-time students studying towards the degree of Master of Engineering. One involves four half-courses in the first term, three half-courses in the second term and a thesis. The other involves four half-courses in each of three terms and does not involve a thesis. In both cases, the candidate must take at least two graduate level half-courses in engineering in each term. Usually no undergraduate engineering courses may be taken for credit. Equivalent alternate programs will be arranged for part-time students. Choice of the alternative to be taken must be arranged and approved at the time of admission into the program.

Each candidate submitting a thesis will be required to undertake an oral examination on the subject of his thesis and related fields.

Full-time graduate students and part-time thesis students are required to attend departmental seminars held regularly to discuss current research and related topics. Each student must, of course, maintain a close working relationship with his supervisor and attend the courses in which he is registered. His supervisor may require him to submit written reports and to present seminars.

Thesis Regulations

The thesis must represent the result of the candidate's independent research or development work, undertaken after admission to graduate standing at Carleton University. Experimental or theoretical results previously published by the candidate may be used only as introductory or background material for the thesis. A candidate may be permitted to carry on thesis research work off-campus, provided that the work is approved in advance and arrangements have been made for supervision of thesis research activities by a faculty member of Carleton University. A part-time student may use the Faculty of Engineering laboratory facilities for on-campus thesis research and development activities.

Waiver of Thesis

A candidate for the Master's degree who has, before admission, completed independent research or development projects of an adequate level of accomplishment, may apply to the chairman of the department concerned for a waiver of the thesis requirement. Such application must be made at the time of initial registration and must be supported by copies of published reports describing the work. If the application is approved, the candidate must take ten half-courses or the equivalent, six of which must be graduate-level courses in engineering, to fulfill the requirement for the award of a degree without a thesis. A candidate who has been granted a waiver of the thesis requirement will be required to take an oral examination on the subject of one of his published papers and topics related to his field of specialization.

Doctor of Philosophy

Admission Requirements

For admission to the Ph.D. program, an applicant must normally hold a Master's degree in engineering (or its equivalent) and, by his previous program of study and scholastic record, demonstrate a capacity for advanced study and research. Experience gained while working in an engineering or research environment will be taken into account when assessing an application. The applicant must specify his intended field of research.

Program Requirements

The specific program requirements for the Ph.D. degree are the following:

- a minimum of two calendar years of full-time study (or the equivalent);

- Course requirements as established on admission, but not less than six half-courses, or equivalent, in total; these requirements must include at least four graduate-level half-courses in engineering and at least one full course in an appropriate discipline outside the Faculty of Engineering.
- substantial research;
- A thesis on the research; each candidate will be required to make an oral presentation of his thesis research and will be examined orally on the subject of his thesis and related fields.

All full-time graduate students and all part-time students actively engaged in research are required to attend departmental seminars held regularly to discuss current research and related topics. Each student is required from time to time to present a seminar on his research.

Each Ph.D. student (full-time or part-time) must obtain satisfactory grades in course work, must make satisfactory progress in the research, and must satisfy the following criteria of activity or "presence" in the program:

- maintain a close working relationship with the research supervisor;
- attend the courses for which he is registered;
- submit written reports and present seminars as required by his supervisor;
- attend departmental seminars;
- be readily available on an informal basis.

Advisory Committee

An advisory committee with at least three members will be appointed by the department soon after a student's first registration. It has the responsibility of ensuring that conditions for the pursuit and completion of his program are fulfilled and it reviews the student's progress at least once a year.

Comprehensive Examination

The comprehensive examination is held approximately one year after initial registration in the program in the case of full-time students, and at an equivalent time in the case of part-time students. The purpose of the examination is threefold:

- to assess the student's comprehensive knowledge of his field of study;
- to assess the preparedness and capability of the student for doctoral research;
- to judge the suitability of the research topic for a doctoral thesis.

The student is required to present his research proposal and to be subjected to oral and written examination in appropriate fields of study. He will be informed by his Advisory Committee of the specific requirements of the examination. Having successfully completed the comprehensive examination, the student becomes a doctoral candidate.

Transfer from Master's to Ph.D. Program

A student who shows outstanding academic performance and demonstrates high promise for advanced research during the full-time Master's program at Carleton may, subject to meeting the requirements below, be permitted to transfer into the Ph.D. program without receiving the Master's degree. Such a student must complete the course requirements and thesis registration requirements of the Master's program but is exempted from submission of the thesis.

A student wishing to transfer should apply to the chairman of the department. If the department and the Faculty of Graduate Studies and Research approve the application, he will be required to take the comprehensive examination for the Ph.D. The requirements for the comprehensive examination will then include the submission of a report on his research to date and a research proposal for the Ph.D.

After successfully passing the comprehensive examination, the student will be admitted to the Ph.D. program with normal program requirements (but with the comprehensive examination to his credit). If he is unsuccessful, he will remain in the Master's program and be required to submit his thesis in the usual way.

Department of Civil Engineering

The Department

Chairman of the Department: John Adjeleian
Departmental Supervisor of Graduate Studies: A.P.S. Selvadurai

The Department of Civil Engineering offers programs of study and research leading to the Master's and Ph.D. degrees in civil engineering.

The Department conducts research and has developed graduate programs in the following areas:

• Structural Mechanics

The graduate program in structural mechanics concentrates on analytical and design studies in the following fields: computer applications in structural analyses; behaviour of steel, concrete and composite structures; structural dynamics, seismic analysis; structural optimization; finite element analysis. Graduate research in structural mechanics is currently directed to the following areas:

Computer Applications in Structural Design
Survey of computer-aided structural design in Canada; computer-based systems for analysis, design and graphics processing.

Seismic Analysis and Design
Seismic response of set-back and other irregular buildings; computer analyses of linear and non-linear structural response; design of buildings for seismic forces.

• Building Design and Construction

The graduate program in building design and construction emphasizes the following fields: masonry behaviour and design, timber structures, structural systems and design optimization; integrated treatment of structural, mechanical and electrical building requirements; construction economics, project planning. Graduate research in building design and construction is currently directed to the following areas:

Masonry Behaviour and Design
Shear strength of reinforced masonry beams; masonry deformations; floor systems for masonry structures; winter masonry construction.

Timber Structures
Performance, analysis and evaluation of timber truss systems; housing applications.

Optimization of Buildings
Optimum design of reinforced concrete and other composite construction taking into account structural, architectural and other service constraints.

• Transportation Planning and Technology

The graduate program in transportation planning and technology deals with problems of policy, planning, economics, design and operations in all modes of transportation. In the area of transportation planning, the focus is on the design of transport systems, including terminals, modelling and simulation, urban and regional studies, traffic engineering and geometric design. In the transportation technology area, programs deal with technology of vehicles and facilities, acoustics and noise, materials and pavement design. Graduate research in transportation is currently focused on the following areas:

Transport Policy
Assessment and impact analysis of national, regional and urban transportation policies.

Planning and Design Methodology
Development and application of models for optimization of transport supply.

Travel and Traffic Analyses
Behavioural theories of passenger travel, goods movement, pedestrian traffic flow characteristics.

Transportation Terminals
Airport planning, air terminal design, bus terminal design, layout methods.

Transportation Technology Development and Assessment
Modernization of passenger and freight rail services; soil properties, pavement design, multi-layered systems, highway design, energy.

• Geotechnical Engineering

The graduate program in geotechnical engineering places a special emphasis on the theoretical studies of soil and rock behaviour, soil-foundation-structure interaction; problems in geomechanics and foundation design. Broader

programs in geotechnical engineering may be arranged by making use of the courses given in the Department of Geography and the Department of Civil Engineering at the University of Ottawa. Graduate research in geotechnical engineering is primarily directed towards the following areas:

Soil-Foundation Interaction
Elastic and consolidation effects of soil-foundation interaction; soil-frame interaction; contact stress measurement; performance of rigid and flexible foundations.

Mechanical Behaviour
Development of constitutive relations for soils and rock masses with yield and creep characteristics; applications to foundation engineering.

Mechanics of Geological Structures
Large strain phenomena; buckling of strata; applications to underground storage structures.

Performance of Anchors
Theoretical and experimental analysis of deep and shallow anchors in soil, rock and concrete; group action; creep effects; prestress loss.

Laboratory facilities include a 400,000 lb. universal testing machine with auxiliary equipment for load and strain control; an electro-hydraulic servo-controlled testing system of 100,000 lb. dynamic capacity; a 10,000 lb. fatigue testing machine, specialized equipment for torsion and impact studies; advanced equipment for electric resistance strain gauge work; and a wide selection of other loading, measuring and recording equipment for testing structural materials and components. The concrete laboratory has facilities for the casting, curing and testing of reinforced concrete members. Laboratory facilities in geotechnical engineering include triaxial and consolidation testing, pore water pressure measurements, model studies of contact stress measurements. The soil dynamics and highway materials laboratories provide facilities for studies of the physical properties of soil, stabilized soil, aggregate and bituminous mixtures.

Computer-related equipment within the Department comprises three terminals, including a computer storage scope display terminal and a digitizing table. This equipment is interfaced through telephone couplers to the SIGMA-9 computer in the University Computer Centre. A library of computer programs for structural engineering is a significant resource for advanced study and research.

Master of Engineering

Admission Requirements

The normal requirements for admission to the Master's program are outlined in the Faculty of Engineering and general sections of this Calendar.

Program Requirements

The Master's program may be undertaken in one of the following optional patterns:
- by course work: 12 half-courses including the project course Engineering 82.590;
- with thesis: normally seven half-courses and a thesis.

In either pattern, the program must be approved by the Department.

Please refer to the Faculty of Engineering section of the Calendar for details of the program requirements.

Doctor of Philosophy

Admission Requirements

The normal requirements for admission to the Ph.D. program are outlined in the Faculty of Engineering section of this Calendar.

Program Requirements

The specific program requirements for the Ph.D. degree are listed in the Faculty of Engineering section of this Calendar.

The program for each candidate will be developed by his advisory committee and must be approved by the Department. The course work requirement for a candidate in civil engineering will normally consist of eight half-courses.

Graduate Courses*

• Engineering 82.511F1
Introductory Elasticity
Stresses and strains in a continuum; transformations, invariants; equations of motion; constitutive relations, generalized Hooke's Law, bounds for elastic constants: strain energy, superposition, uniqueness; formulation of plane stress and plane strain problems in rectangular Cartesian and curvilinear coordinates; Airy-Michell stress functions and Fourier solutions, application of classical solutions to problems of engineering interest.
A.P.S. Selvadurai.

• Engineering 82.512W1
Advanced Elasticity
Continuation of topics introduced in 82.511. Complex variable solutions. Torsional and thermal stresses; axially symmetric three-dimensional problems, Love's strain potential, Boussinesq-Galerkin stress functions: problems related to infinite and semi-infinite domains. Introduction to numerical methods of stress analysis, comparison of solutions.

• Engineering 82.513F1
Finite Element Methods in Stress Analysis
Finite element theory and numerical methods. Constant strain triangles. Linear strain triangles. Reinforced triangles. Axi-symmetric shells. Axi-symmetric solids. Plates in bending. Throughout the course, application to engineering problems is emphasized.
W.H. Bowes.

• Engineering 82.514F1
Earthquake Analysis and Design of Structures
Structural dynamics, single and multidegree of freedom systems, formulation of equations of motion, free and forced vibrations, normal mode analysis. Seismological background, selection of design earthquake. Deterministic analysis of earthquake response, linear and non-linear analysis, influence of foundation medium. Design considerations and code requirements, equivalent static load method, response spectrum approach.
J.L. Humar.

• Engineering 82.523W1
Theory of Structural Stability
Elastic and inelastic behaviour of beam-columns; elastic and inelastic buckling of frames; application of energy methods to buckling problems; lateral-torsional buckling of columns and beams; buckling of plates; local buckling of columns and beams.
Prerequisite: Engineering 82.525 or equivalent.

• Engineering 82.524W1
Behaviour of Steel Structures
Steel as a structural material; bolted and welded connections; brittle fracture and fatigue; members subjected to combined bending and compression, and to twist and local buckling; structural stability of frames.
J.L. Humar.

• Engineering 82.525F1
Analysis of Elastic Structures
Application of matrices to structural analysis; force and displacement method of analysis for framed elastic planar and space structures; introduction to structural dynamics.
J.L. Humar.

• Engineering 82.526W1
Prestressed Concrete
Outline and scope of design concepts. Flexural behaviour, shear, bond, losses. End block design. Post tensioned slabs. Some considerations on bridge design. Pavements. Design optimization.
Prerequisite: Engineering 82.528 or permission of the instructor.
J.J. Salinas.

• Engineering 82.527W1
Advanced Structural Design
A number of topics such as the evolution of a structure, structural form, aesthetics, progressive collapse, and design in various structural materials are treated by members of the Department and outside experts.
John Adjeleian and G.T. Suter.

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

• Engineering 82.528F1
Advanced Reinforced Concrete
The research background, development, and limitations in current building code provisions for reinforced concrete; yield line theory of slabs; safety and limit states design; computer design of concrete structures.
G.A. Hartley.

• Engineering 82.529F1
Foundation Engineering - Case History
The critical study and the consideration of case histories relating to current procedures of design and construction of foundations, earth-retaining structures and earth slopes.
G.C. McRostie.

• Engineering 82.530W1
Advanced Soil Mechanics I
Effective stress, pore pressure parameters, saturated and partially saturated soils; seepage; permeability tensor, solutions of the Laplace equation; elastic equilibrium; anisotropy, non-homogeneity, consolidation theories; shear strength of cohesive and cohesionless soils.
A.P.S. Selvadurai.

• Engineering 82.531F1
Advanced Soil Mechanics II
Plasticity in soil mechanics; failure and yield criteria, plastic equilibrium, upper and lower bound solutions, uniqueness theorems; statically and kinematically admissible states; stability analysis of cohesive and cohesionless soils.
A.P.S. Selvadurai.

• Engineering 82.533F1
Pavements and Materials I
An analysis of the interaction of materials, traffic and climate in the planning, design construction, evaluation, maintenance and rehabilitation of highway and airport pavements.

• Engineering 82.534F1
Intercity Transportation, Planning and Management I
Framework and process of intercity transport planning and management. Intercity transport demand and supply. Network analysis and simulation. Introduction to transport projects and systems evaluation.
A.M. Khan.

• Engineering 82.535F1
Traffic Engineering 1
Introduction to principles of traffic engineering. Basic characteristics of drivers, vehicles, and traffic. Volume, speed and delay studies. Traffic stream characteristics and queueing theory. Capacity analysis of roads and intersections. Safety.
J.P. Braaksma.

• Engineering 82.537W1
Urban Transportation Planning and Management
Urban transportation systems planning and management. Urban development models - an introduction. Urban transportation policy.
A.M. Khan.

• Engineering 82.538W1
Geometric Design
Basic highway geometric design concepts. Vertical and horizontal alignment. Cross-sections. Interchange forms and design. Adaptability and spacing of interchanges. Design of operational flexibility; operational uniformity, and route continuity on freeways.
J.P. Braaksma.

• Engineering 82.541W1
Transportation Economics
Transportation, economic analysis framework. Transport industry output. Carrier operations. Issues of resource utilization, measurement, economics of supply of infrastructure, pricing, subsidies, externalities. Transport policy in Canada.
K.W. Studnicki-Gizbert.

• Engineering 82.563W1
Computer-Aided Design of Building Structures
Relevant aspects of computer systems, information handling, auxiliary storage; design methods, computerized design systems; computer graphics; application of structural theory; examination of a selected series of structural engineering programs and programming systems.
E.W. Wright.

• Engineering 82.570F1, W1
Special Topics in Building Design and Construction
Courses in special topics related to building

design and construction, not covered by other graduate courses, may be offered from time to time. Course details will be available some months prior to registration.

The following courses have been scheduled for the 1978-1979 session:

Topic for Fall 1978:

• Project Management
Introduction to managing the development, design, and construction of buildings. Examination of project management for the total development process, including interrelationships among owners, developers, financing sources, designers, contractors and users; role and tasks of the project manager; setting of project objectives; feasibility analyses; budgets and financing; government regulations; environmental and social constraints, control of cost, time and content (quality and process); human factors.

Topic for Winter 1979:

• Engineered Masonry Behaviour and Design
Properties of brick, block, mortar, grout and steel. Testing, field control and inspection. Structural behaviour and design of plain and reinforced masonry walls, beams, and columns. High rise design and earthquake requirements. G.T. Suter.

• Engineering 82.572W1
Special Topics in Geotechnical Engineering
Courses in special topics in geotechnical engineering, not covered by other graduate courses, may be offered from time to time. Course details will be available some months prior to registration.

• Engineering 82.574W1
Special Topics in Transportation Planning and Technology
Courses in special topics in transportation engineering, not covered by other graduate courses, may be offered from time to time. Course details will be available some months prior to registration.

• Engineering 82.590F2, W2, S2
Civil Engineering Project
Students enrolled in the M.Eng. program by course work will conduct an engineering study, analysis or design project under the general supervision of a member of the Department. Results will be given in the form of a written report and presented at a Departmental seminar.

• Engineering 82.596F1, W1, S1
Directed Studies

• Engineering 82.599F3, W3, S3
M.Eng. Thesis

• Engineering 82.699F, W, S
Ph.D. Thesis

Courses Not Offered in 1978-79

82.536 Pavements and Materials II
82.539 Intercity Transportation Planning and Management II
82.540 Traffic Engineering II

Other Courses of Particular Interest

Mechanical and Aeronautical Engineering
88.509 Some Engineering Aspects of Air and Water Pollution
88.514 Ground Transportation Systems and Vehicles
88.517 Experimental Stress Analysis
88.521 Methods of Energy Conversion
88.550 Advanced Vibration Analysis
88.561 Design Theory and Practice
88.562 Failure Prevention
88.568 Deformation of Materials

Systems Engineering and Computing Science
94.501 Simulation and Modelling
94.515 Socioeconomic System Models
94.560 Engineering Methods in Numerical Analysis

Geography
45.415 Slope Development: Forms, Processes and Stability
45.416 Engineering Geomorphology
45.417 Glacial Geomorphology
45.532 Experimental Geomorphology
45.533 Periglacial Geomorphology

45.534 Aspects of Clay Mineralogy and Soil Chemistry
45.579 Research and Development in Recreational Geography

Public Administration
50.510 Management Accounting
50.511 Financial Management

Mathematics
69.409 Mathematical Methods II

Civil Engineering, University of Ottawa
CVG 5100 Foundations
CVG 5101 Analysis of Stress and Strain in Rock Masses
CVG 5104 Soil Testing and Properties
CVG 5105 Slope Stability
CVG 5106 Soil Engineering
CVG 5147 Theory of Plates
CVG 5148 Theory of Shells
CVG 5341 Finite Element Methods I
CVG 5349 Mine Waste Embankments

Department of Electronics

The Department

Chairman of the Department: A.R. Boothroyd
Departmental Supervisor of Graduate Studies: R.E. Thomas

The Department of Electronics offers programs of study and research leading to the Master's and Ph.D. degrees in electrical engineering.

The graduate programs are directed towards study and research in the following interrelated fields:

Solid State Device Electronics
Semiconductor devices and integrated circuits; basic physical electronics; device modelling and computer-aided design; device innovation.

Device Fabrication
Development of fabrication processes; bipolar and surface controlled devices; CCD's; integrated circuit realization of electron systems, special purpose devices for instrumentation; transducers.

Circuits and Circuit Theory
Active filter, linear and digital integrated circuit design, computer-aided circuit design, subnanosecond TDR measurement techniques.

Microwave Electronics
Active and passive circuit and device techniques for communication and radar systems applications.

Communications Electronics
Circuits and subsystems for terrestrial and satellite communications; digital modulation techniques; characterization of non-linear elements.

Industrial Instrumentation Electronics
Industrial measurement and process control; radar remote sensing; application of basic electromagnetics and circuit technology.

Technology of Analogue Signal Processing
Solid state imagers, transversal filters, CCD delay lines, use in analogue signal processing applications.

The structure of courses offered allows a well-integrated Master's or Ph.D. program of study to be chosen, appropriately related to the field of thesis research. Basic courses cover semiconductor device theory, circuit and electromagnetic theory. Application-oriented courses include integrated circuit design, instrumentation techniques, microwave measurements and circuits, semiconductor device design and fabrication processing.

The research activity of the Department is conducted mainly in the Solid State Electronics Laboratory and the Applied Instrumentation Laboratory.

The Applied Instrumentation Laboratory is concerned generally with measurement and instrumentation problems in the fields of communications, energy, transportation, agriculture and the manufacturing industries. Its activities range from research into basic aspects of measurement and instrumentation processes to the development of specific electronic instrumentation systems. Extensive collaboration is maintained with government and industrial research and development agencies in the Ottawa area.

Extensive facilities are available for the fabrication of solid state devices and integrated circuits for research purposes. These include a laboratory in which processes required in silicon monolithic technology can be carried out under conditions of cleanliness and control comparable with those in industrial research laboratories. Among equipment items available are modern diffusion furnaces, an epitaxial reactor system, facilities for photolithography, and mask-making vacuum system for thin film deposition, scribing, bonding and probing systems. Well-developed laboratory facilities exist for circuit work.

The Applied Instrumentation Laboratory possesses an extensive variety of general purpose laboratory instruments spanning the range from Dc to optical frequencies. In addition, the Laboratory has a number of sophisticated special purpose facilities such as network analyzer systems and dedicated computing systems.

Master of Engineering

Admission Requirements

The normal requirements for admission to the Master's program are outlined in the Faculty

of Engineering and general sections of this Calendar.

Program Requirements

The Master's program may be undertaken in one of the following optional patterns:

- with thesis: normally seven half-courses and a thesis;
- by course work: 12 half-courses.

In either pattern, the program must be approved by the Department.

The non-thesis alternative for the Master of Engineering degree is offered for both full-time and part-time students.

To be accepted for the program, full-time or part-time, a student must provide evidence of having had sufficient practical experience and of having attained a sufficient technical ability since the Bachelor's degree. In addition, the applicant will be required to indicate his current level of engineering responsibility. Usually, at least two years of appropriate engineering experience will be required to qualify for entry to the program.

The course program for each student will be worked out on an individual basis by the student's faculty adviser and may include project courses involving laboratory work and/or directed studies courses.

The following courses are basic to the areas of study specified:

- Solid State Devices: 97.580, 97.558
- Microwaves: *97.551*, 97.562 or 97.589
- Circuits: *97.555*, 97.557

Students in electronics must normally take two of the italicized courses.

Doctor of Philosophy

Admission Requirements

The normal requirements for admission to the Ph.D. program are outlined in the Faculty of Engineering section of this Calendar.

Program Requirements

The specific program requirements for the Ph.D. degree are listed in the Faculty of Engineering section of this Calendar; normally six half-courses are required.

The program for each candidate will be developed by his Advisory Committee and must be approved by the Department.

Graduate Courses*

- Engineering 97.551F1
Passive Microwave Circuits
Circuit aspects of passive microwave components and systems with emphasis on concepts employed in the design and use of passive microwave devices. Review of EM theory, transmission lines and waveguides. Microwave network analysis. Scattering-matrix characterization of reciprocal microwave junctions and discontinuities. Ferrites, nonreciprocal junctions, isolators and circulators. Design, characteristics and use of microwave components such as transformers, filters, hybrids, tuners, and directional couplers, with particular emphasis on their realization in stripline and microstrip integrated circuits.
B.A. Syrett.

- Engineering 97.552F1, W1, S1
Studies in Electronics
A course of study designed to satisfy the individual needs of students wishing to pursue studies in electronics beyond the scope of the regular courses offered. It can consist of parts of regular courses, project tasks and directed study, in any combination. The intent is to provide for studies in new areas, or on topics which cut across existing course offerings. The details of the course are worked out by the student's adviser or research supervisor and must be approved by the chairman of the Department.

- Engineering 97.555F1
Passive Circuit Theory
General description of networks leading to matrix representation of n-terminal lumped and distributed networks. Elements of matrix algebra as applied to networks. Properties of

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

network functions; poles and zeros of driving point and transfer functions. Foster and Cauer canonic forms. Synthesis of lossless 2-ports; single and double-terminated. Modern filter theory; approximation of characteristics by rational functions; Butterworth and Chebyshev approximations.
P.D. van der Puije.

• Engineering 97.557W1
Active Circuit Theory
Characterization of negative resistance 1-port networks; signal generation and amplification. Active 2-ports; y, z, h, k, chain and scattering parameters. Measurement of 2-port parameters. Activity and passivity; reciprocity, non-reciprocity and anti-reciprocity. Gyrator as a circuit element. Stability, inherent and conditional; power gain of conjugate and mismatched 2-port amplifiers. Amplifier gain sensitivity. Oscillators, maximal loading and frequency sensitivity. Active filter design; gyrator, negative immittance convertor (NIC) and operational amplifier used as functional elements. Practical realization of gyrators and NIC's. Active network synthesis.
Prerequisite: Engineering 97.555 or equivalent.
P.D. van der Puije.

• Engineering 97.558W1
Surface-Controlled Semiconductor Devices
Review of the theory of semiconductor surfaces and interfaces. Surface characterization. Surface recombination. Study of surface dependent devices: MIS capacitors, gate controlled (field plate) diodes, MOS transistors. MIS memory elements, metal-semiconductor contacts. Complementary MOS transistors. Charge-coupled devices. Schottky barrier devices. Surface effects in shallow junctions and lateral bipolar transistors. Special devices.
Prerequisite: Engineering 97.580 or equivalent.
R.E. Thomas.

• Engineering 97.559F1
Solid State Devices Fabrication Technology
Processes used in fabrication of silicon planar devices and integrated circuits. Crystal growth, epitaxy, thermal oxidation, solid state diffusion, vacuum processes, photolithography. Characterization and limitation of processes. Design consideration for discrete devices and integrated circuits. Methods of material, process and device assessment. Thin and thick film technologies. Ion implantation. Bipolar and MOS technology sequences.
R.E. Thomas.

• Engineering 97.562F1
Microwave Solid State Electronics
Discussion of basic principles of operation of varactor diodes, parametric amplifiers, p-i-n diodes, microwave switches, limiters and phase shifters. Schottky barrier devices, detector and mixer circuits. Avalanche transit-time microwave diodes, bulk gallium arsenide devices, microwave transistors.
L.A. Stark.

• Engineering 97.563W1
Communications Technology
The course emphasizes the design and analysis of satellite and ground station communications systems, coaxial cable systems FM line-of-sight microwave links, CATV systems, digital data transmission systems and HF communications, troposcatter and video transmission techniques and systems. Particular attention is given to the concepts of noise, the effects of nonlinearities and the various modulation techniques.
W.J. Chudobiak.

• Engineering 97.564W1
Advanced Instrumentation Techniques
The study and design of electronic systems for industrial and earth resource non-contacting measurement applications. Emphasis will be on the physical and mathematical modelling of the parameters and materials of interest in addition to the synthesis of measurement systems. Possible topics include systems for high accuracy material thickness determination, range and velocity resolution, object detection, intrusion detection, moisture content determination, geophysical applications, and other topics selected from the current literature. Particular attention will be given to RF, microwave, and radar techniques.
W.J. Chudobiak.

• Engineering 97.565F1
Fiber-Optical Communications
Transmission characteristics of optical waveguides; electroluminescent sources such as light-emitting diodes, gallium arsenide lasers and gas lasers; photo-diodes, avalanche de-

tectors; external beam modulators; repeater design; coupling devices for fibers; noise generation and measurements; inter-modulation, cross-modulation and non-linearity characterization; analogue systems, digital systems, system design accounting for component signal degradation; free-space links; data bus systems; introduction to integrated optics.

• Engineering 97.566W1
Communication Circuits and Sub-System Design
Theory and design of video and radio frequency communication circuits. Nonlinear operational amplifier circuits for video signal limiting, signal multiplication, division, amplitude and frequency modulation, amplitude and frequency demodulation, waveform generation. Nonlinear controlled source circuits for radio frequency mixing, RF amplitude and frequency modulation, RF amplitude and frequency demodulation. Phase locked loop fundamentals such as noise performance, tracking, acquisition and optimization; or noise suppression techniques such as shielding, grounding, balancing and decoupling.
J.S. Wight.

• Engineering 97.567F1
Antenna Engineering
Theory, design and measurement of antennas. Point sources, dipoles, loop antennas, helical, biconical, reflector, slot and horn antennas, apertures, sampled apertures, periodic, aperiodic and random arrays. Synthetic apertures. Determination of radiation patterns, radiation resistance, and polarization.
J.S. Wight.

• Engineering 97.580F1
Theory of Semiconductor Devices
Review of solid state physics underlying device mechanisms. Equilibrium and non-equilibrium conditions in a semiconductor. Physical theory of basic semiconductor device structures and aspects of design: PN junctions and bipolar transistors. Basic current transport relationships. Charge control theory. Modelling of device mechanisms. Large and small signal models of bipolar transistors. Performance limitations of transistors.
A.R. Boothroyd.

• Engineering 97.581F1
Electronic Circuit Reliability
The course is concerned with basic considerations in electronic circuit reliability, with particular reference to integrated circuits. Introduction to reliability statistics. Probability density distribution functions (for example, Gaussian, Log normal, Weibull, etc.). Failure analysis. Determination of Confidence Limits, risk, MTFB, MTTF, estimators and Bathtub Curve. Reliability assurance. Reliability physics. Failure causes, modes and mechanisms in semiconductor devices and I.C.'s. Reaction kinetics (the Arrhenius relationship). Reliability testing of I.C.'s. Environmental screen tests. Burn-in. Life tests, electrical testing. Functional testing. Cost considerations. Advanced failure analysis tests (for example, SEM, X-Ray, Microprobe, Ion probe). Semiconductor test structures. Selected examples. Special emphasis on LSI Systems.
D.V. Sulway.

• Engineering 97.584F1
Integrated Circuit Design
A course aimed at the engineer interested in basic integrated circuit design and realization. Emphasis placed on computer aids available for design, with testing stressed as integral part of development and use of I.C.'s. Overview of design process, touching on each of major tasks - partitioning, layout, mask making, wafer fabrication, and testing. Review of basic devices in major I.C. technologies, particularly CMOS. Design of simple I.C.'s and cells for LSI, in context of circuit simulation. Modelling of I.C. elements and cells - overall assessment of chip behaviour and test development. Brief discussion of reliability.
D.M. Caughey.

• Engineering 97.585F1
Modern Integrated Circuit Systems
A course aimed at the engineer involved in system design either in custom LSI form, or using off-the-shelf integrated circuits. Realization of sequential circuits - SSI/MSI, ROM, microprocessor with ROM, PLA. Study of systems organization on the IC chip - ROM, PROM, RAM, PLA, calculator chips, LSI partitioning. Circuit aspects of static and dynamic MOS LSI logic and shift registers. Multiplexing. Clocking systems. Capacitive power

and chip output problems. Charge transfer systems (CCD's), digital and analogue, including filters and imaging arrays.
M.A. Copeland.

• Engineering 97.587W1
Microprocessor Electronics
Basic elements of a microprocessor system, typical organization considerations of the LSI chip design, fabrication technology, cost and performance, comparison of the available alternatives. Study of example applications. Constraints imposed by the microprocessor on design of interacting integrated circuits, A/D converters, sensors and transducers. I/O problems.

• Engineering 97.589F1, W1
Advanced Topics in Electronics
A course dealing with selected advanced topics of recent interest in the broad field of solid state devices, electronic circuits and electromagnetics. Specified topics to be announced each year. Course usually given on a seminar basis with students' presentations on assigned topics.

Topics for 1978-79:

• RF and Microwave Measurement Techniques
Basic aspects of measurement techniques and instrumentation from RF to microwave frequencies. Measurement of power, impedance, frequency and wavelength, phase and time-interval, insertion loss and attenuation, resonant circuit parameters, circuit constants in lumped-element and distributed-element circuits, electrical properties of materials. Receiver measurements and antenna measurements. Instrumentation discussed will include power sensors, RF bridges, slotted-line techniques, TDR, spectrum analysis, vector voltmeters, and microwave network analysis.
B.A. Syrett.

• Solar Energy Conversion
Comparative study of devices and techniques of solar energy conversion with special emphasis on semiconductor solar cells.
R.E. Thomas.

• Engineering 97.590F1, W1, S1
Engineering Project
Project for students pursuing the non-thesis M.Eng. program. An engineering study, analysis and/or design project under the supervision of a faculty member. Results will be given in the form of a written report and presented at a Departmental seminar.

• Engineering 97.596F1, W1, S1
Directed Studies
Various possibilities exist for pursuing directed studies on topics approved by a course supervisor, including the above listed course topics where they are not offered on a formal basis.

• Engineering 97.599F3, W3, S3
M.Eng. Thesis

• Engineering 97.699F, W, S
Ph.D. Thesis

Courses Not Offered in 1978-79

97.550 Physics of Semiconductor Materials and Devices
97.586 Computer-Aided Circuit Design

Other Courses of Particular Interest

Of particular interest to students in electronics are the courses offered by the Department of Systems Engineering and Computing Science.

Department of Mechanical and Aeronautical Engineering

The Department

Chairman of the Department:
H.I.H. Saravanamuttoo
Departmental Supervisor of Graduate Studies:
R.J. Kind

The Department of Mechanical and Aeronautical Engineering offers programs of study and research leading to M.Eng. degrees in aeronautical engineering, materials engineering and mechanical engineering, and to Ph.D. degrees in aeronautical engineering and mechanical engineering. The M.Eng. degree can be earned by a combination of course work and thesis or by course work alone.

Programs of research and study can be offered in the three broad areas of thermofluid-dynamics, mechanical analysis and design, and materials. Courses are available in the particular fields of:

- Aerodynamics
- Internal Gas Dynamics
- Heat Transfer
- Noise and Aero-Acoustics
- Stress and Failure Analysis
- Vibration Analysis
- Engineering Design
- Material Properties
- Material Processing
- Vehicle Engineering
- Nuclear Engineering
- Energy Conversion and Utilization
- Energy Systems Planning
- Air and Water Pollution

The Departmental research activities are focused on several areas of technology where some of the above fields interact. Programs of study and research may be chosen in one or two of the fields above, or in one of these areas of technology.

The Department has a major research commitment, both analytical and experimental, to thermofluid-dynamic and mechanical problems of gas turbine engine design and operation. Current projects include flow prediction and analysis in turbomachines; two- and three-dimensional boundary layer behaviour; dynamics of gas turbine power plants; design and performance of highly loaded turbines; noise generation in fans, compressors and turbines; noise propagation in acoustically treated ducts; stress, deformation and vibration of compressor and turbine blades and discs; optimum design of blades and discs; finite element analysis; dynamics of high speed rotors; electron beam welding of refractory metals; failure modes of materials in extreme environments.

As part of the faculty interest in transportation, the Department is active in research on air and ground vehicle technology. Current studies include: vortex-wake generation by large aircraft; aircraft noise; boundary layer separation and control; model simulation of snow drifting on airports and roadways; optimization of off-road vehicle design; vehicle-terrain interaction; effect of vibration on vehicle performance; dynamics of air-cushioned and magnetically levitated vehicles; composite material structural elements.

Applied heat transfer research is concentrated in two main areas: one is the study of mixing and heat transfer problems in nuclear power reactors; the other involves the computer simulation of the performance of building environmental control systems with a view to minimizing energy consumption.

Members of the Department provide the nucleus of Carleton University's Energy Research Group, which is engaged in interdisciplinary studies on the effectiveness of energy utilization in industrialized societies. In particular, studies are being undertaken on the optimization of nuclear reactor power plants for energy utilization, on energy utilization in transportation, in buildings and in industry and on the effects of price on energy supply and demand. A related interest in the Department in in air- and water-pollution problems associated with energy utilization.

Another area of interest of the Department is in materials and fabrication technology. In particular, there is a considerable effort in welding metallurgy techniques and in the design of welded structures. In addition, the general area of fracture mechanics and defect design techniques is developing and is applied both to design and materials evaluation. Facilities in this area include an electron beam system, an electron microscope and associated analytical facilities and fracture mechanics testing equipment.

The Departmental laboratories are well equipped for the various research activities described above, and these are supported by a machine shop and an electronics shop. In addition to the extensive laboratory facilities, the faculty maintains several small computers. The University Xerox Data Systems twin SIGMA-9 computer facility is also used for major computations and is accessible at a large number of remote terminals in the Mackenzie Building.

The extensive laboratory facilities of the National Research Council and of the Department of Energy, Mines and Resources are also used, by special arrangement, for research and graduate studies of mutual interest. Strong contacts are maintained with the gas turbine and nuclear power industries.

Master of Engineering

Admission Requirements

The normal requirements for admission to the Master's program are outlined in the Faculty of Engineering and general sections of this Calendar.

Program Requirements

The Master's program may be undertaken in one of the following optional patterns:

- by course work: 12 half-courses;
- with thesis: normally seven half-courses and a thesis.

In either pattern, the program must be approved by the Department.

The course work Master's program in either mechanical or aeronautical engineering is intended for students whose career objectives are best satisfied by a somewhat broader extension of their engineering background knowledge than that offered by a more specialized research program. The course of study will be tailored to suit the career objectives of each student individually, and must show depth of study in more than one field. The ability to do significant work in engineering without detailed supervision is an essential attribute for a holder of a Master's degree. Therefore, one full course of the program is specified to be 88.572, Independent Engineering Study.

The following course requirements must normally be met for the degree by course work: a total of six full courses or equivalent, of which

- at least one full course or equivalent must be in an area of engineering outside the main field of study;
- one full course shall be an independent study (88.572);
- at least one half-course must be an approved advanced-level course in mathematics, physics or chemistry.

Doctor of Philosophy

Admission Requirements

The normal requirements for admission to the Ph.D. program are outlined in the Faculty of Engineering section of this Calendar.

Program Requirements

The specific program requirements for the Ph.D. degree are listed in the Faculty of Engineering section of this Calendar.

The program for each candidate will be developed by his Advisory Committee and must be approved by the Department.

Graduate Courses*

- Engineering 88.501F1

Theory of Viscous and Turbulent Flows
Navier-Stokes and boundary layer equations; mean flow equations for turbulent kinetic energy; integral formulations. Stability, transition, turbulence, Reynolds stresses; separation. Calculation methods, closure schemes. Com-

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pressibility, heat transfer and three-dimensional effects.
Gary Elfstrom.

• Engineering 88.502T2
Hypersonic Flow
Basic equations of inviscid, unsteady hypersonic flow. Small disturbance theory. Newtonian theory. Optimum body shapes. Blunt body theory. Hypersonic flow past oscillatory wedges and cones. Hypersonic boundary layers.
Paul Mandl.

• Engineering 88.504F1
Compressible Non-Viscous Flow
Steady isentropic, frictional and diabatic flow; shock waves; irrotational compressible flow, small perturbation theory and similarity rules; second-order theory, unsteady one-dimensional flow.
R.J. Kind.

• Engineering 88.508W1
Experimental Methods in Fluid Mechanics
Fundamentals of techniques of simulation of fluid dynamic phenomena. Theoretical basis, principles of design, performance and instrumentation of ground test facilities. Applications to aerodynamic testing (subsonic to hypersonic speeds); wind effects on structures; air and water pollution.
Julius Lukasiewicz and others.

• Engineering 88.510W1
Performance and Economics of Aircraft
Aircraft performance analysis with emphasis on factors affecting take-off, landing and economic performance. High lift schemes. Direct and indirect operating costs; route analysis and operational problems.
R.J. Kind.

• Engineering 88.511F1
Dynamics and Aerodynamics of Low Speed Flight
Brief review of static stability theory. Euler's equations for rigid body motion; the linearized equations of motion; stability derivatives and their estimation. Longitudinal and lateral dynamic response of an aircraft to control and disturbance.
L.T. Filotas.

• Engineering 88.514W1
Ground Transportation Systems and Vehicles
Performance characteristics, handling and directional stability, ride comfort and safety of various types of ground vehicle systems, including road vehicles, terrain-vehicle systems, guided transport systems and advanced ground transport technology.
J.Y. Wong.

• Engineering 88.517F1
Experimental Stress Analysis
Introduction to theory of elasticity. Photoelasticity: types of polariscope, two- and three-dimensional stress fields, frozen patterns. Photoelastic coatings. Strain gauges; gauge factors sensitivity, calibration and temperature compensation. Moire fringes, brittle lacquers, mechanical strain gauges.
Robert Bell.

• Engineering 88.521W1
Methods of Energy Conversion
The course covers technical, economic and environmental aspects of developing methods of energy conversion, as applied to large-scale systems. Among topics included are: fuel cells, MHD, fusion, solar energy, wind, geo-thermal and tidal energy.
J.T. Rogers.

• Engineering 88.530F1
Acoustics and Noise
Fundamentals of vibrations of solids and fluids; plane waves; spherical waves. Transmission and reflection; acoustic impedance and matching. Resonators and filters. Absorption in fluids. Introduction to acoustic measurements; loudspeakers, microphones. Introduction to aeroacoustics and jet noise.
A.N. Abdelhamid.

• Engineering 88.541F1
Turbomachinery
This course deals with the generalized performance of turbomachinery, and with the thermo- and aerodynamic design of axial and radial flow machines. The emphasis is on compressible flow machines.
D.A.J. Millar.

• Engineering 88.542W1
Gas Turbines
Interrelationship among thermodynamic, aerodynamic and mechanical design. Ideal and real cycle calculations. Cycle optimization; turboshaft, turbojet, turbofan. Component performance. Off-design performance; matching of compressor, turbine, nozzle. Twin-spool matching.
H.I.H. Saravanamuttoo.

• Engineering 88.543F1
Advanced Thermodynamics
Equilibrium; first law, second law, state principle, and zeroth law; criteria of equilibrium, temperature, entropy and availability; Maxwell relations; open systems; phase rule; systems of one and two components; idealized gases, mixtures and solutions; equations of state; thermodynamic potentials; chemical reactions and chemical equilibrium.
E.G. Plett.

• Engineering 88.548W1
Convective Heat and Mass Transfer
Review of analogies between heat, mass and momentum transfer. Free and forced convection from theoretical and experimental viewpoint for laminar and turbulent flows in ducts and over flat plates and blunt bodies. Heat transfer-friction relationship in heat exchangers. Film and dropwise condensation. Boiling with forced and natural convection. Two-phase flow. Mass transfer in stationary, laminar and turbulent flow systems.
E.G. Plett.

• Engineering 88.550W1
Advanced Vibration Analysis
General theory of discrete multi-dregree-of-freedom vibrating systems. Emphasis on numerical techniques of solving complex vibrating systems with selected applications from aeronautical, civil and mechanical engineering.
James Kirkhope.

• Engineering 88.561W1
Design Theory and Practice (Creative Problem Solving)
This course outlines problem-solving processes and how they can be applied in engineering design. The student will be introduced to and be expected to practice various systematic and creative problem-solving techniques. The emphasis is on the student's learning methodologies rather than accumulating information. The techniques may be successfully applied in any engineering specialty.
Geza Kardos.

• Engineering 88.562F1
Failure Prevention (Fracture Mechanics and Fatigue)
The course deals with the design of engineering structures to ensure against failure due to fatigue or brittle fracture. It emphasizes an understanding of the nature of fatigue and brittle fracture and thereby the selection of suitable material, geometry and inspection procedures for the load and environmental condition intended.
Geza Kardos.

• Engineering 88.567W1
Special Topics in Materials Engineering I (Fracture of Structural Materials)
Fracture mechanics, fracture toughness testing. Microscopic aspects of plastic deformation, crack nucleation and propagation under static and cyclic loading. The physical meaning of fracture toughness.
J.A. Goldak.

• Engineering 88.568F1
Deformation of Materials
This is intended to be a general course for mechanical and civil engineers dealing with the metallurgical and materials principles that control the mechanical properties and deformation of materials. Topics to be covered include elasticity, anelasticity, yield point phenomena, plastic flow, strain hardening, Bauschinger effect, fracture, viscoelastic deformation.
M.J. Bibby.

• Engineering 88.569W1
Special Topics in Materials Engineering II (Welding Metallurgy)
The metallurgical structure of the fusion zones and heat-affected zones is related to the mechanical properties and welding parameters of welded joints. The course emphasis is on high strength low alloy steels.
M.J. Bibby.

• Engineering 88.570T1
Special Topics in Mechanical and Aeronautical Engineering
Courses in special topics related to mechanical engineering and aeronautical engineering, not covered by other graduate courses, may be offered from time to time. Course details will be available some months prior to registration.
R.J. Kind and others.

• Engineering 88.571T1
Advanced Topics in Mechanical and Aeronautical Engineering
Courses in advanced specialized topics related to mechanical engineering and aeronautical engineering, not covered by other graduate courses, may be offered. Such courses will normally be given only to Ph.D.-level students. Course details will be available some months prior to registration.
R.J. Kind and others.

• Engineering 88.572T2
Independent Engineering Study
In this course, the student pursuing a Master's degree by course work will carry out an independent study, analysis and solution of an engineering problem or design project. The results will be given in the form of a written report and presented at a Departmental seminar. The study will be carried out under the general direction of a faculty member.
R.J. Kind and others.

• Engineering 88.596F1, W1, S1
Directed Studies

• Engineering 88.599F3, W3, S3
M.Eng. Thesis

• Engineering 88.699F, W, S
Ph.D. Thesis

Courses Not Offered in 1978-79

88.503 Incompressible Non-Viscous Flow
88.505 Aerodynamics of Wings and Bodies
88.509 Some Engineering Aspects of Air and Water Pollution
88.531 Aero-Acoustics
88.547 Conductive and Radiative Heat Transfer
88.549 Two-Phase Flow and Heat Transfer
88.566 Introduction to Modern Materials Analysis

Other Courses of Particular Interest

Civil Engineering
82.511 Introductory Elasticity
82.512 Advanced Elasticity
82.513 Finite Element Methods in Stress Analysis
82.534 Transportation Planning I

Systems Engineering and Computing Science
94.504 Computer Methods in Industrial Engineering
94.505 Optimization Theory and Methods
94.553 Stochastic Processes

Physics
75.447 Statistical Physics (Statistical Thermodynamics)

Mathematics
70.446 Hydrodynamics and Elasticity
70.486 Numerical Analysis
70.543 Mathematical Methods in Fluid Dynamics

Department of Mechanical Engineering, University of Ottawa
MCG 5112 Rarefied Gas Dynamics
MCG 5126 Properties of Materials at Low Temperatures
MCG 5127 Advanced Production Planning and Control
MCG 5128 Industrial Organization
MCG 5135 Geothermal Energy Exchange
MCG 4128 Basic Nuclear Engineering
MCG 5166 Nuclear Engineering Fundamentals
MCG 5167 Nuclear Reactor Engineering
MCG 5172 Special Topics in Systems Engineering
MCG 5191 Combustion

Department of Systems Engineering and Computing Science

The Department

Chairman of the Department: D.C. Coll
Departmental Supervisor of Graduate Studies: S.A. Mahmoud

The Department of Systems Engineering and Computing Science offers programs of study and research leading to the M.Eng. and Ph.D. degrees in electrical engineering; with the participation of the Department of Mechanical and Aeronautical Engineering, M.Eng. and Ph.D. programs are also offered in mechanical engineering. A program leading to the M.Sc. degree in information and systems science is offered in cooperation with the Department of Mathematics.

The Departmental program centers upon the analysis and design of systems whose primary function is the processing of information. Within this context, four interrelated areas of study receive major attention:

- Computer Communications and Data Base Systems
- Communications and Signal Processing
- Computer Systems Engineering
- Modelling, Simulation, Optimization and Control

An integrated course program provides students with the fundamental basics and allows specialization in one or more of the above areas as desired. The research program emphasizes the development and application of modern methods of information systems engineering pertinent to these areas. Work undertaken includes both theoretical studies and the related problems of practicable realizations. Specific research topics are often associated with one or more major projects, such as the Wired City Simulation Laboratory, the Transparent Intelligent Network, and Speech Research Group.

Computing systems play a central role in the research and teaching activities of the Department. The facilities available to the student include interactive time-sharing and remote batch terminals linked to the University's Xerox SIGMA-9 digital computer and several small- to medium-sized computers available within the Department. These include a PDP-15 with interactive graphics, a PDP-11/55, PDP-11/60, GT-44, and GT-40 computer, all with graphic capability. Also available are a number of PDP-8 computers and several microprocessors systems. Applications include information storage and retrieval, speech processing, image processing/communications, and studies of man-machine communications.

Full advantage is taken within the Department of the technology-oriented government/industry/university complex in the Ottawa area. Cooperative projects exist with the Department of Communications, Communications Research Centre, the National Research Council, Bell Northern Research Laboratories, the Ministry of Transport, and COSTPRO.

Students wishing to pursue a computing specialization in systems engineering may be required to take appropriate undergraduate computing science courses for which credit may be allowed.

Master of Engineering

Admission Requirements

The normal requirements for admission to the Master's program are outlined in the Faculty of Engineering and general sections of this Calendar.

Program Requirements

Two options are available for the Master's program:

- thesis program, normally comprising seven half-courses and a thesis;
- non-thesis program, comprising 12 half-courses, and including either project course Engineering 94.590, 94.591, or 94.592.

Certain courses are fundamental to advanced study in the various Departmental areas of specialization. These are Engineering 94.552,

94.553, 94.557, and 94.574. All M.Eng. students in systems engineering must complete at least two of these (but may complete more than two if they wish). The most suitable combination of these core courses should be chosen by the student in consultation with his program adviser at the time of initial registration.

M.Sc. Program in Information and Systems Science

This is a program administered jointly by the Department of Mathematics and the Department of Systems Engineering and Computing Science, which leads to an M.Sc. (Information and Systems Science). Intended primarily for students whose first degree is not in electrical engineering, it allows candidates to pursue studies in information systems engineering, communications and signal processing, computing science, or mathematical systems theory.

Applicants who desire admission to the information and systems science program are required to have an Honours degree in a related discipline, with at least three years of mathematics and a strong undergraduate preparation in computer science; otherwise the General Regulations apply. The normal program consists of eight half-courses of which two must be taken in the Department of Mathematics, and a thesis.

The program is more fully described on page 114 of this Calendar.

Doctor of Philosophy

Admission Requirements

The normal requirements for admission to the Ph.D. program are outlined in the Faculty of Engineering section of this Calendar.

Program Requirements

The specific program requirements for the Ph.D. degree are listed in the Faculty of Engineering section of this Calendar.

The program for each candidate will be developed by his Advisory Committee and must be approved by the Department.

Graduate Courses*

• Engineering 94.501W1
Simulation and Modelling
Simulation of continuous and discrete processes, with emphasis on the latter. Model building. Continuous time systems: analogue models, digital approximations; continuous simulation languages. Simulation of discrete event-oriented processes. Specialized simulation languages: GPSS, SIMSCRIPT, GASP, SIMPAC. Monte Carlo methods. Experimental design and statistical analysis of results.
J.E. Neilson.

• Engineering 94.504F1
Computer Methods in Industrial Engineering
Linear programming. Simplex and revised simplex methods. Duality. Assignment and transportation problems. Integer programming. Network models and algorithms, shortest path and maximum flow problems. Critical path and PERT.
Bernard Pagurek.

• Engineering 94.505W1
Optimization Theory and Methods
A second-level course in optimization theory and computer-oriented optimization methods. Lagrange's method of undetermined multipliers. Unconstrained optimization: steepest-descent, Newton-Raphson, conjugate gradient, variable metric, and Powell-Zangwill methods. Nonlinear programming: Kuhn-Tucker conditions, saddle point theory and dual problems, computational techniques. Function space techniques and introduction to optimal control.
Bernard Pagurek.

• Engineering 94.515W1
Socioeconomic Systems Models
The mathematical structures of models used in manpower, health-care systems, input-output, econometric, industrial dynamics, techno-

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The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

logical forecasting, transportation and 'world' modelling. The uses and limitations of Markov chains, differential/difference equation and linear ratio models. Judgmental modelling, including cross-impact and 'Systems Dynamics' methods. The use of model optimization in policy studies.
Prerequisites: Engineering 94.552 and 94.553 or permission of the instructor.
C.M. Woodside.

• Engineering 94.516W1
Theory of Large Systems and Networks
Examples of networks and a description of engineering problems in their design and analysis. Elements of queueing theory and its application to network problems. Theory of networks and graphs; reliability; simulation; optimization. Application of methods and theories to engineering problems.
Prerequisites: Engineering 94.521, 94.552 and 94.553.

• Engineering 94.517W1
Queueing, Scheduling and Control of Information Systems
An intermediate-level course in queueing theory, with emphasis on useful approximations (diffusion, heavy traffic). M/G/1, G/M/1 and G/G/1 systems; closed and open networks of Markovian queues. Scheduling, priority queueing, design of queueing nets and real-time control. Applications to information systems (computer scheduling, data concentrators, libraries, health-care systems).
Prerequisite: Engineering 94.553.
C.M. Woodside.

• Engineering 94.518W1
Topics in Information Systems
This course is designed to introduce the research student to recent developments in information systems design.
Prerequisite: Engineering 94.574 or permission of the instructor.

• Engineering 94.521F1
Computer Communication Systems I
A first-level course in computer communications systems which provides both theoretical and practical background. It consists of two separate but interwoven streams. The first introduces basic applications of stochastic process and queueing theory to computer communication systems. The second describes various data communication applications and examines their specific hardware, software and communications requirements: local loop, central office, toll office and switching hierarchy, echo suppressors, analogue transmission, line equalization, different types of codes, modems, digital transmission, interfaces, error detection and connections, STDM and ATDM, optimum block size, store and forward packet switching, networks such as ARPA. Introduction to transparent intelligent networks.
M.E. Ulug.

• Engineering 94.524W1
Computer Communication Systems II
A second-level course in computer communication systems which consists of two separate but interwoven streams. The first covers the advanced applications of stochastic process and queueing theory to computer communication systems. The second introduces different types of systems architectures. Stochastic message flow and delays in different types of computer communication networks, including the ones using satellite links in subnet, are analyzed; private and shared systems are compared; the calculation of buffer sizes and overflow probabilities for different types of traffic mixes are introduced; a number of flow control methods are described. Design of transparent intelligent networks.
Prerequisite: Engineering 94.521.
M.E. Ulug.

• Engineering 94.539F1, W1
Advanced Topics in Digital Systems Design
A course dealing with recent and advanced topics in the field of digital systems design and related areas. Students registered in the course are expected to present one or more lectures or seminars on assigned topics.
Prerequisites: Engineering 94.557, 94.558 and permission of the instructor.
B.A. Bowen.

• Engineering 94.551W1
Estimation and Forecasting
Models for time series analysis: autogressive, moving average processes. Decision theory: hypothesis testing, likelihood ratio tests. Mini-

mum risk, maximum likelihood and Bayesian estimators. Estimation of parameters of time series models, least squares and maximum likelihood, recursive techniques. Wiener-Kalmann filters. Prediction and forecasting.
Prerequisite: Engineering 94.553.
Bernard Pagurek.

• Engineering 94.552F1
Advanced Linear Systems
A unified treatment of linear dynamic systems and techniques for their analysis. Review of matrix algebra and complex variable theory. Properties of linear systems. Classical solution of differential and difference equations. Transform methods; Laplace, Fourier and z- transforms. State space representation and matrix methods. Elementary functional analysis to Hilbert spaces and operators.
S.A. Mahmoud.

• Engineering 94.553F1, W1
Stochastic Processes
Basic concepts of probability theory, random variables; distribution and density functions, functions of a random variable, averages, moments, characteristic functions. Random signals in linear systems; power measurement, correlation, spectral analysis. Markov processes. Introduction to filtering and estimation. Markov chains. Elements of queueing theory.
J.S. Riordon and C.M. Woodside.

• Engineering 94.554W1
Data Communications I
Digital communications systems: characterization of information and noise signals; source encoding; communications processes; basic decision theory; optimum receivers. System performance: error probabilities for common digital modulation systems.
Prerequisite: Engineering 94.553.
D.A. George.

• Engineering 94.556W1
Advanced Stochastic Processes
Wiener process, Levy's theorem. Poisson process. Markov processes, Chapman-Kolmogoroff equation, Fokker-Planck equations. Modelling physical processes. The stochastic integral and diffusion equations. Least square estimator; Wiener-Kalman filter, linear smoothing filter, selected non-linear estimation problems in communication and control.
Prerequisite: Engineering 94.553 and one of 94.551 and 94.554.

• Engineering 94.557F1
Fundamentals of Discrete Systems
Introduction to the theory and applications of discrete mathematics to the analysis and design of the software and hardware of computers and computing systems. Digital machine theory: group theory and applications to finite state machines; algebras and combinatorial logic design, homomorphic maps and application to group codes; rings and fields and their application to cyclic codes. Graphs: graph and tree structures, directed graphs; applications to reliability, reachability and searches; classes of polynomial complete and incomplete problems with graph representation. Languages and grammars: finite automata, stack structured computers, Polish notation, queueing structures and grammars.
Prerequisites: Engineering 94.466 or permission of the instructor.
S.A. Mahmoud.

• Engineering 94.558F1
Digital Systems Architecture
Architectural features of computers and computer-based systems. Computer classifications (SISD, SIMD, MISD, MIMD). SISD computers including autonomous memories and bus-oriented central processors. The major computer architectural components: Bus structures, ROM controllers, CACHE memories, associative memory systems. Stack computers, fully parallel computing, and pipe line processing. Summary of other architectures and performance evaluation.
Prerequisites: A logic course at the undergraduate level; programming experience in a high-level language and some assembly language familiarity; permission of the instructor.
B.A. Bowen.

• Engineering 94.562W1
Digital Signal Processing
Signal representations, z- transform and difference equations. Digital filters; recursive design techniques for FIR and IIR filters, quantization effects. Discrete Fourier trans-

form: properties, correlation and convolution, chirp z- transform. Fast Fourier transform: algorithms and implementation. Random signal analysis: estimators, sampling distributions, averaging, correlation and spectral estimates, windowing for leakage suppression and stability improvement. Hardware and software implementations of digital filters. Speech analysis and synthesis, predictive encoding, and other current applications.
Prerequisites: Engineering 94.552 and 94.553.
L.R. Morris.

• Engineering 94.565F1
Data Communication
Demodulation of digital communication signals. Intersymbol interference: distorting channels, equalization, adaptive systems. Partial response signalling. Synchronization and timing. Error correction codes.
Prerequisite: Engineering 94.554.
D.C. Coll.

• Engineering 94.567W1
Source Coding and Data Compression
Discrete and continuous cources: Markov and filtered noise models; the rate distortion functions. Discrete source coding: Huffman coding, run length encoding; text, black/white television, digitized script. Continuous sources: PCM, DPCM, and delta modulation, tolerance violation coding. Fourier and Walsh transform coding; speech, facsimile, telemetry, television. Speech compression by parameter extraction. Compression by tree coding; discrete sources with fidelity criterion, generalization of delta modulation.
Prerequisites: Engineering 94.552 and 94.553.
J.K. Cavers.

• Engineering 94.571F1
Mini/Microcomputer Operating Systems
Theory and practice of structured real time operating system design. Design using high-level concurrent languages and graphical techniques; operating system kernel (nucleus) organization; mapping the kernel onto low-level software and hardware; implementation of operating systems on different hardware architectures, including multiple processor configurations; conflicting requirements of efficiency, speed, flexibility, modularity; consideration of failure recovery, reliability, integrity, protection; features of standard operating systems (RMX/80, RSX/11 and others). Special purpose operating systems for mini/microcomputers with examples drawn from systems developed or under development at Carleton using PDP-11 and INTEL-8080 hardware.
Prerequisites: Engineering 94.303 or 94.461, plus 94.574 (or equivalent).
R.J.A. Buhr.

• Engineering 94.572F1
Topics in Software Engineering
Topics of current interest in the practice of software engineering. Examples (not all of which are offered in a given year) include cooperating processes, language selection and design, process specification, interactive graphics, and software measurement and evaluation.
Prerequisite: Engineering 94.574.
R.J.A. Buhr and members of the Department.

• Engineering 94.573W1
Integrated Data Base Systems
The purpose of this course is to present the underlying principles behind the organization of data bases and data base management systems and to relate these principles to current practice and trends. Theory of data base organization: hierarchical, network and relational approaches; data and storage structures. Data description languages. Data base management systems: the special purpose and the host language approaches. Organization of data management software. Shared data bases. Online access and up-date. Significance of associative processing. Performance. Integrity and security. Comparative analysis of selected current systems, including CODASYL/DBTG and IMS, and discussion of trends and examples. Assignments will include hands-on experience with a live data base.
Prerequisite: Engineering 94.574.
J.S. Riordon.

• Engineering 94.574F1
Software Engineering Fundamentals
Computing systems from a software point of view. System organization: hierarchical multi-level machines, the conventional machine level, the microprogramming level, the operating system level, translator levels. Operating system

design: cooperating sequential processes, semaphores, monitor, O/S kernel, handlers. Discrete structures: graphs, finite state machines. Data structures: logical organization, physical organization, sorting and searching.
Prerequisite: Programming experience, with at least one high-level language and, preferably, with assembly language.
J.E. Neilson.

• Engineering 94.575W1
Software Translators and Their Applications
Concepts efficiency, expandability, correctness, and compactness. Application in query and edit systems, intelligent terminals, file translations, the design of input/output specifications. Scanners, finite state machines, grammars, parsers, code generators. A significant project to implement a non-trivial translator will be required, involving complex data structures, searching and sorting, overlaying strategies, error detection and recovery strategies, interfacing with operating systems and human engineering.
Prerequisites: Engineering 94.574 or 94.480 and 94.481.
W.R. LaLonde.

• Engineering 94.576F1
Analytical Performance Models of Computer Systems
Analytical modelling techniques for performance analysis of computing systems. Theoretical techniques covered include single and multiple class queueing network models, together with a treatment of computational techniques, approximations and limitations. Applications include scheduling, memory management, peripheral devices, data bases, multiprocessing, and distributed computing.
Prerequisite: Engineering 94.517.
R.J.A. Buhr and J.E. Neilson.

• Engineering 94.577W1
Teleprocessing Software Design
Current theory and practice in teleprocessing software design. Review of basic teleprocessing functions and subsystems: code conversion, line control, error control, synchronization; teleprocessing devices and networks. Access methods (TCAM-OS/VS), communications controllers, languages, emulation programming. Data communications systems and host computer interface configurations. Modular software design for front end processors, message switchers, remote concentrators and intelligent terminals. Network control programs and high-level interprocess communications in resource sharing multicomputer networks.
Prerequisites: Engineering 95.401 and 94.521.
S.A. Mahmoud.

• Engineering 94.579F1, W1
Advanced Topics in Software Engineering
A course dealing with recent and advanced topics in the field of software engineering and related areas. Primary references are recent publications in the field. Students registered in the course are expected to present one or more lectures or seminars on assigned topics.
Prerequisite: Engineering 94.572 and permission of the instructor.
R.J.A. Buhr.

• Engineering 94.582W1
Topics in Information and Systems Science
Fundamental results in design and analysis of efficient computer algorithms for large, complex problems. Areas of application include data manipulation, computer networks, queueing systems, and optimization.
(Also offered as Mathematics 70.582)
R.J.A. Buhr and Frantisek Fiala.

• Engineering 94.584F1, W1
Advanced Topics in Communications Systems
Recent and advanced topics in communication systems. Students registered in the course are expected to present one or more lectures or seminars on assigned topics.
Prerequisite: Engineering 94.565 and permission of the instructor.
D.A. George.

• Engineering 94.589W1
Advanced Topics in Operations Research and System Theory
Recent and advanced topics in optimization, queueing theory, dynamic systems, estimation for systems analysis, the theory of networks, and similar areas. A seminar course for Ph.D. students and (with permission) advanced Master's students.
Bernard Pagurek and C.M. Woodside.

• Engineering 94.590F1, W1, S1
Systems Engineering Project
Students pursuing the non-thesis M.Eng. program will conduct an engineering study, analysis, and/or design project under the supervision of a faculty member. Results will be given in the form of a typewritten report and presented at a Departmental seminar.

• Engineering 94.591F2, W2, S2
Systems Engineering Project
Project similar to 94.590 but either of greater scope or longer duration. Results will be given as a typed report and presented in a seminar.

• Engineering 94.592T2
Systems Engineering Project
(Same description as 94.591, but spread over two terms)

• Engineering 94.596F1, W1, S1
Directed Studies

• Engineering 70/94.598F3, W3, S3
Master's Thesis in Information and Systems Science

• Engineering 94.599F3, W3, S3
M.Eng. Thesis

• Engineering 94.699F, W, S
Ph.D. Thesis

Departmental Program Descriptions and Details of Courses

Faculty of Science

Dean: J.L. Wolfson

Department of Biology

The Department

Chairman of the Department: J.M. Neelin
Associate Chairman, Graduate Studies:
H.G. Merriam

The Department of Biology offers programs of study and research leading to the M.Sc. and Ph.D. degrees. The research activities of the faculty members of the Department are currently directed to three major areas:

Molecular and Developmental Biology
T.W. Betz, V.N. Iyer, P.E. Lee, M.E. McCully, J.M. Neelin, George Setterfield, Hiroshi Yamazaki

Physiology
D.R. Gardner, S.L. Jacobson, K.W. Joy, John Sinclair, J.A. Webb, Frank Wightman

Ecology and Systematics
C.A. Barlow, I.L. Bayly, G.R. Carmody, M.B. Fenton, H.F. Howden, W.I. Illman, J.D.H. Lambert, H.G. Merriam, H.H.J. Nesbitt, D.A. Smith

The Department welcomes applications from graduates with degrees in the biological sciences. Since current trends indicate that students in the non-biological sciences (chemistry, engineering, mathematics, physics, psychology, etc.) may also be suited to undertake valuable research and graduate work in biology, the Department encourages graduates in other scientific disciplines to apply. If admitted, such students may take additional courses in biology to make up deficiencies in their background; the completion of these extra courses will generally not require more than one additional year of study.

Graduate offerings of the Departments of Biology and Chemistry include projects and courses which may be appropriate for students with an interest or background in biochemistry.

The Department accepts part-time graduate students but cannot guarantee that they will be able to fulfill all the requirements for their degree outside of normal working hours.

The Department of Biology has cooperative agreements with the National Research Council, the Research Branch of Agriculture Canada, Environment Canada and the National Museum of Natural Sciences in Ottawa, whereby certain scientists from these institutions may assist graduate students with particular research projects, subject to the approval of the departments concerned.

Each graduate student will be assigned an Advisory Committee consisting of a supervisor and two advisers. The student's course program and the research program from the planning phase onward will be subject to this Committee's approval.

Applications normally must be fully documented by July 31 in order to be considered for registration in the following September.

Qualifying Year Program

Candidates who lack the minimum qualifications for admission to the Master's program must register in and successfully complete a Qualifying Year program.

Normally, prescribed courses will include 61.498. Refer to the general section of this Calendar for details of the regulations governing the Qualifying Year.

Master of Science

Admission Requirements

Applicants will be considered if they hold an Honours B.Sc. degree (or equivalent) with at least high second-class standing (Carleton grade point equivalent of 8.0 in major subject) and are acceptable to the Graduate Committee of the Department of Biology.

Program Requirements

The candidate will complete at least five approved full courses (or the equivalent), including a research thesis equivalent to a maximum of three full course credits. Not more than one-half of the formal course requirement may be satisfied by Directed Special Studies or reading courses. The thesis must be defended successfully at an oral examination.

All candidates are also expected to attend and must give at least one Departmental research seminar. Candidates may be required to demonstrate a reading knowledge of one language other than English and to take certain technical or other courses.

Doctor of Philosophy

Admission Requirements

Applicants holding an M.Sc. degree from a recognized university and who are acceptable to the Graduate Committee of the Department of Biology will be considered for admission into the Ph.D. program.

An applicant with an Honours bachelor's degree who has achieved an outstanding academic record and, in addition, exhibits very strong motivation and high promise for advanced research, may be admitted to the Ph.D. program directly. Such candidates will be required to complete at least 15 full courses, or the equivalent.

Students who have been admitted to the Master's program may be permitted to transfer into the Ph.D. program if they show outstanding academic performance and demonstrate high promise for advanced research during the first year of the Master's program.

Program Requirements

Over a period of two years or more, the candidate must complete the following:

- ten full courses, or the equivalent;
- an oral comprehensive examination, which normally must be undertaken not later than 15 months after initial registration in a Ph.D. program;
- a research thesis equivalent to a maximum of eight of the required ten full course credits which must be defended successfully at an oral examination.

All candidates are also expected to attend and must give at least one Departmental research seminar. Candidates may be required to demonstrate a reading knowledge of one or two languages other than English and to take certain technical or other courses.

Students who have been admitted to the Ph.D. program on the basis of a 15-course requirement, which will normally require three years of full-time study, must complete the following:

- 15 full courses, or the equivalent;
- a comprehensive examination;
- a research thesis equivalent to a maximum of ten of the 15-course requirement;
- the language requirement outlined above.

Students in either a ten-course or a 15-course Ph.D. program may not satisfy more than one-half of their formal course requirements by Directed Special Studies or reading courses.

Graduate Courses*

- Biology 61.510T2
Advanced Plant Morphogenesis
An advanced course dealing with selected topics in plant morphogenesis.
M.E. McCully.

- Biology 61.520T2
Advanced Cell Biology
An advanced lecture and seminar course dealing with recent developments in cell biology. Emphasis will be on cell structures and molecular mechanisms involved in regulation of basic cell processes. Nuclear organization, chromosome structure, composition and replication, nucleic acid structure and function, virus organization, ribosomes, protein synthesis and enzyme regulation will be considered in detail. The course is offered jointly with the Biology Department, University of Ottawa. In addition to the regular professors, specialist guest lecturers from local government laboratories and other universities are frequent contributors. Although students are encouraged to enroll for the entire course, the first or second terms may be taken singly under the course numbers 61.521 and 61.522. Credit for Biology

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

61.520 precludes credit for Biology 61.521 and 61.522.
Prerequisite: A course in basic cell biology, biochemistry and/or genetics.
George Setterfield and J.G. Kaplan, organizers.

• Biology 61.521F1
Advanced Cell Biology I
Course description, prerequisite and lecturers as described under Biology 61.520. Precludes credit for Biology 61.520.

• Biology 61.522W1
Advanced Cell Biology II
Course description, prerequisite and lecturers as described under Biology 61.520. Precludes credit for Biology 61.520.

• Biology 61.530T2
Plant Biochemistry
An advanced course covering selected topics in plant biochemistry.
Prerequisite: Biology 61.425 or permission of the instructors.
K.W. Joy, J.A. Webb and Frank Wightman.

• Biology 61.542T2
Developmental Endocrinology
An experimental analysis of basic endocrinology, neuroendocrinology and modes of hormone action in developing vertebrates.
Prerequisites: Biology 61.335 and permission of the instructor.
T.W. Betz.

• Biology 61.548T2
Population Biology of Species and Communities
A seminar course in quantitative aspects of species and community ecology.
G.R. Carmody, H.G. Merriam and guest lecturers.

• Biology 61.550T2
Selected Topics
Courses in selected aspects of specialized biological subjects, not covered by other graduate courses, may be offered. Course details will be available at registration.

• Biology 61.551F1
Advanced Topics
Courses in selected aspects of specialized biological subjects, not covered by other graduate courses; course details will be available at registration.

• Biology 61.552W1
Advanced Topics
Courses in selected aspects of specialized biological subjects, not covered by other graduate courses; course details will be available at registration.

• Biology 61.555T2
Advanced Insect Morphology
A course devoted to an advanced study of insect morphology and phylogeny.
Prerequisite: Biology 61.460.
H.H.J. Nesbitt.

• Biology 61.565F1, W1, S1
Field Course
A half-course involving intense, continuous study of living organisms under natural conditions. Credit is based on three weeks of full-time field work with attendant assignments, selected from several one- or two-week modules with various instructors. Costs of long-distance transport (if applicable) and room and board relating to the course are borne by the student. (Details may be obtained from the coordinator.) Persons having used Biology 61.365 for credit may not use the modules they took for 61.365 towards 61.565. Modular exchange may be arranged between 61.565 and 61.545.
Day Division: all day, approximately six days a week, offered at different times during the year.
M.B. Fenton, coordinator.

• Biology 61.570T2
Evolution and Biogeography
H.F. Howden.

• Biology 61.575T2
Mammalogy
A lecture, seminar, and laboratory course on the taxonomy, distribution, behaviour, and ecology of mammals.
Prerequisites: Biology 61.360 and 61.415, or permission of the instructor.
D.A. Smith or M.B. Fenton.

• Biology 61.590T2
Directed Special Studies and Research

• Biology 61.599F4, W4, S4
M.Sc. Thesis

• Biology 61.699F, W, S
Ph.D. Thesis

Courses Not Offered in 1978-79

61.500 Current Developments in Molecular Genetics
61.502 Regulations of Macromolecular Biosynthesis
61.525 Plant Physiology
61.535 Special Studies in Physiology
61.549 Mathematical Modelling for Biologists
61.556 Advanced Insect Taxonomy
61.557 Acarology

The Department

Chairman of the Department: C.H. Amberg
Departmental Supervisor of Graduate Studies: C.H. Langford

The Department of Chemistry offers opportunities for advanced study and research leading to the degrees of M.Sc. and Ph.D. At the Ph.D. level, research is currently focused on the areas of bio-organic chemistry and metal ion chemistry. The Department encourages part-time graduate study at the M.Sc. level, particularly for high school teachers and for government and industrial chemists living in the Ottawa area. Admission and program requirements are the same as those for full-time students, although an alternative program may be available incorporating a one-credit thesis for off-campus research.

The current research interests of the Department of Chemistry are:
C.H. Amberg, *Heterogeneous Catalysis and the Surfaces of Non-Metallic Solids*
J.W. ApSimon, *Natural Products Chemistry*
R.G. Barradas, *Electrochemistry and Electroanalytical Chemistry*
G.W. Buchanan, *^{1}H and ^{13}C NMR Spectroscopy*
C.L. Chakrabarti, *Analytical Chemistry and Atomic Spectroscopy*
J.M. Holmes, *Surface Chemistry*
J.A. Koningstein, *Raman Spectroscopy of the Solid State*
Peeter Kruus, *Structure and Dynamics of Liquids*
C.H. Langford, *Metal Ion Chemistry and Photochemistry in Solution*
P.M. Laughton, *Physical Organic Chemistry*
Michael Parris, *Inorganic Stereochemistry*
R.A. Shigeishi, *Surface Studies of Gas-Metal Systems*
C.S. Tsai, *Mechanisms of Enzyme Reactions*
D.C. Wigfield, *Mechanistic and Biosynthetic Organic Chemistry*
R.H. Wightman, *Synthesis of Oligonucleotides and Pseudo Aromatic Hydrocarbons*
D.R. Wiles, *Inorganic and Analytical Radiochemistry*
J.S. Wright, *Theoretical Chemistry*

Joint supervision of research projects by the following Adjunct Professors is possible:
H.J. Bernstein, *Spectroscopy*
E.J. Casey, *Electrical Power Sources and Biophysics*
O.E. Edwards, *Natural Products and Mechanistic Organic Chemistry*
E.A. Flood, *Thermodynamics and Surface Chemistry*
S.A. Narang, *Nucleic Acid Chemistry*
I.E. Puddington, *Colloid Chemistry*
I.C.P. Smith, *NMR Studies of Biologically Important Molecules*

Graduate offerings of the Departments of Biology and Chemistry include projects and courses which may be appropriate for students with an interest or background in biochemistry.

For additional information regarding these areas of research or any other aspect of graduate work in chemistry, students should contact the chairman of the Department.

Master of Science

Admission Requirements

The normal requirement for admission to the Master's program is an Honours B.Sc. degree in chemistry with at least high second-class standing. Candidates who do not qualify for direct admission into the Master's program may be accepted into a Qualifying Year program as specified in the General Regulations section of this Calendar.

Preparation in the fields of mathematics and physics is also required.

Applicants may in some cases be required to write the Graduate Record Examinations before their admission.

Program Requirements

The specific program requirements in the Department of Chemistry are the following:
- three full courses, or the equivalent;
- a research thesis, which must be defended at a final oral examination;
- a reading knowledge of *two* languages other than English, normally chosen from French, German, and Russian.

Additional preparatory courses may be recommended if deemed necessary at the time of registration.

Doctor of Philosophy

Admission Requirements

Ordinarily, an M.Sc. degree (or the equivalent) from a recognized university is required for admission to the Ph.D. program. This program consists of the equivalent of ten full course credits.

An applicant with an Honours B.Sc. degree in chemistry who has achieved an outstanding academic record and, in addition, exhibits very strong motivation and high promise for advanced research, may be admitted to the Ph.D. program directly. Such candidates will be required to complete the equivalent of at least 15 full courses.

Applicants may be required to write the Graduate Record Examinations before their admission. In some cases, preliminary registration in the M.Sc. program may be recommended.

Program Requirements

The normal requirements in the Ph.D. program are the following:

- a minimum of two years of full-time study and research;
- three full courses (or the equivalent) at the graduate level;
- A comprehensive examination in chemistry which will be completed approximately one year before submission of the thesis; this will normally take the form of written general examinations in all phases of chemistry, to be taken during the first 15 months of Ph.D. enrollment, and a series of cumulative examinations in the area of specialization. These examinations are available every month during the fall and winter terms, and the candidate must pass six out of the first 16 papers attempted.
- a Ph.D. thesis equivalent to seven full courses;
- a reading knowledge of two languages other than English, normally chosen from French, German and Russian.

Students who have been admitted to the Ph.D. program on the basis of a 15-course requirement must complete the following:

- a minimum of seven full courses;
- a comprehensive examination in chemistry, as above;
- a research thesis equivalent to a maximum of eight full courses;
- the language requirement outlined above.

This program will normally require at least three years of full-time study.

Graduate Courses*

- Chemistry 65.509W1
Molecular Spectroscopy
Molecular electronic, rotational and vibrational spectroscopy.
Prerequisites: Chemistry 65.310 or equivalent.
(Also offered as Physics 75.522)
J.A. Koningstein.

- Chemistry 65.517F1
Physical Chemistry of Solutions
The structure and dynamics of liquids and solutions is discussed, with emphasis on the assumptions and principles present in the fundamental theoretical models, and the interrelationships among the experimental methods used for investigation - thermodynamic, transport, ultrasonic and dielectric properties, together with IR and Raman spectroscopy, NMR relaxation, and light and neutron scattering.
Prerequisites: Chemistry 65.411 or equivalent.
Peeter Kruus.

- Chemistry 65.519F1
Chemical Kinetics
Theories of rates of chemical reactions with application to reactions in gaseous and condensed systems. May not be taken for credit concurrently with Chemistry 65.412.
Prerequisite: Chemistry 65.310 or permission of the instructor.

- Chemistry 65.522F1
Electrolyte Theory and Electrode Processes

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

Homogeneous and heterogeneous electrochemistry. May not be taken for credit concurrently with 65.450.
R.G. Barradas.

• Chemistry 65.523W1
Electrochemical Technology
Applied electrochemistry, that is, corrosion electro-analysis, electro-organics, batteries, novel power sources.
Prerequisite: Chemistry 65.522.
R.G. Barradas.

• Chemistry 65.526W1
Nucleic Acid Chemistry
A survey of the chemistry and biochemistry of nucleic acids and their components.
Prerequisites: Chemistry 65.422, 65.423 or equivalents.
R.H. Wightman and S.A. Narang.

• Chemistry 65.527F1
Physical Organic Chemistry
Reaction mechanisms in organic chemistry, linear free energy relationships and methods of approaching transition state structure. Applications of molecular orbital theory to organic chemistry.
Prerequisites: Chemistry 65.410 and 65.420 or equivalents.
P.M. Laughton and D.C. Wigfield.

• Chemistry 65.528W1
Non Proton Magnetic Resonance
Applications of ^{13}C NMR chemical shifts, couplings and relaxation times to structure and dynamics in organic and biochemical systems. Deuterium NMR and its biochemical and biological applications.
Prerequisite: Chemistry 65.422 or equivalent.
G.W. Buchanan and I.C.P. Smith.

• Chemistry 65.533W1
Biosynthesis of Natural Products
Biosynthetic routes leading to the more important classes of natural products. Methodology of attacking biosynthetic problems using radioactive tracer techniques.
Prerequisite: Chemistry 65.320 or equivalent.
D.C. Wigfield.

• Chemistry 65.550F1
Analytical Instrumentation
A survey of recent developments in chemical transduction and signal processing with a review of the electronic methodology required.
Prerequisite: Chemistry 65.431 or permission of the instructor.

• Chemistry 65.561F1
Metal Ions in Solution
A study of mechanistic pathways of simple inorganic reactions including substitution, redox and photochemical. Analytical applications of kinetics will be included.
Prerequisites: Chemistry 65.310 and 65.350 or equivalent and permission of the instructor.
C.H. Langford.

• Chemistry 65.581T2
Seminars in Biological and Organic Chemistry
The course will consist of one-hour seminars not directly related to the student's research problem. There will be an examination covering aspects of other student presentations and those from visiting speakers.

• Chemistry 65.582T2
Seminars in Physical and Inorganic Chemistry
The course will consist of one-hour seminars not directly related to the student's research problem. There will be an examination covering aspects of other student presentations and those from visiting speakers.

• Chemistry 65.590T2
Directed Special Studies
Students may register for this course more than once provided that topics covered are sufficiently different to constitute separate studies.

• Chemistry 65.599F4, W4, S4
M.Sc. Thesis

• Chemistry 65.699F, W, S
Ph.D. Thesis

Courses Not Offered in 1978-79

65.515 Applications of Group Theory
65.516 Quantum Chemistry
65.520 Surface Chemistry
65.521 Catalysis
65.525 Natural Products Chemistry

65.530 Heterocycles and Organic Synthesis
65.531 Biochemistry of Enzyme Action
65.532 Mechanisms of Biochemical Reactions
65.555 Analytical Atomic Spectroscopy - Absorption
65.556 Analytical Atomic Spectroscopy - Emission and Fluorescence
65.559 Chemical Effects of Nuclear Transformations

Department of Geology

The Department

Chairman of the Department: J.M. Moore
Departmental Supervisors of Graduate Studies: G.B. Skippen and Giorgio Ranalli

The Department of Geology offers programs of research and study leading to the degrees of Master of Science and Doctor of Philosophy. Currently, the three principal fields of graduate study and research are:

Resource Geology
R.L. Borden, P.A. Hill, I.R. Jonasson, F.K. North, D.F. Sangster, W.M. Tupper, D.H. Watkinson, R.W. Yole

Pre-Cambrian Geology
Keith Bell, J.A. Donaldson, Edgar Froese, Edward Irving, J.M. Moore, G.B. Skippen

Structure and Geodynamics
R.L. Brown, F.K. North, Giorgio Ranalli

Current research in the Department includes: applied geochemistry, mineral deposits, petroleum geology, experimental mineralogy, geochemistry, geochronology, metamorphic and igneous petrology, sedimentology and stratigraphy, structural analysis and geodynamics, crystallography (G.Y. Chao) and palaeontology (Kenneth Hooper and Jarmila Kukalova-Peck).

Qualifying Year Program

Applicants with a general (pass) Bachelor's degree may be admitted to a Qualifying Year program designed to raise their standing to the Honours level. Refer to the general section of this Calendar for details of the regulations governing the Qualifying Year.

Master of Science

Admission Requirements

The normal requirement for admission to the Master's program is an Honours bachelor's degree, with at least second-class standing in geology or a related discipline.

Program Requirements

M.Sc. by Thesis

- three full courses at the graduate level in geology, or in certain cases, in an ancillary science;
- informal examination by the candidate's advisory committee to determine whether or not additional non-credit courses should be prescribed;
- a thesis based on the student's own research, which must be defended at an oral examination.

M.Sc. by Course Work

- A Master's degree may be obtained by completing five full course credits without presenting a thesis; this option, which requires Departmental approval, emphasizes the applied aspects of geology and is primarily intended for students with prior professional experience. Particular emphasis is placed upon mineral resource management and mineral exploration. Up to half of the five credits (which must be completed within three consecutive academic terms in the case of full-time students) may be in subject areas outside geology, such as economics, law, commerce or international affairs.

Doctor of Philosophy

Admission Requirements

The minimum requirements for admission to the Ph.D. program are outlined in the general section of this Calendar. The normal requirement is an M.Sc. in geology or a related discipline.

Students who have been admitted to the Master's program may be permitted to transfer into the Ph.D. program if they show outstanding academic performance and demonstrate significant promise for advanced research during the first year of the Master's program.

Program Requirements

- a minimum of two courses at the graduate level in geology or a related discipline;

- informal examination by the candidate's advisory committee to determine whether or not additional non-credit courses should be prescribed;
- A reading knowledge of geological subjects in a language other than English; the language chosen must be relevant to the candidate's field of research. This requirement is to be completed before the end of the second year in the Ph.D. program, and may be met by completing successfully a formal language course or by examination within the Department of Geology.
- comprehensive examination with emphasis on areas chosen by the advisory committee in consultation with the candidate; the examination will normally be oral and will be undertaken at the end of the first year of study.
- a thesis contributing to basic knowledge in the geological sciences or related fields, which must be defended successfully at an oral examination.

Selection of Courses

Senior undergraduate courses may be taken by graduate students with the approval of the Department of Geology. One course or its equivalent may be taken by Master's candidates in partial fulfillment of their degree requirements.

In addition to the courses offered by the Department, graduate students in geology may select, in partial fulfillment of their degree requirements, certain fourth-year courses offered by the Department of Chemistry and some of the following graduate courses offered by the Department of Geography:

Geography
45.532 Experimental Geomorphology
45.533 Periglacial Geomorphology
45.534 Aspects of Clay Mineralogy and Soil Chemistry
45.535 Glaciology

Through inter-university cooperation in graduate instruction, full-time graduate students registered at Carleton may arrange to enroll in up to four of the following half-courses at the University of Ottawa:

Geo 5310, 5311 Palaeontology I and II
Geo 5320, 5321 Mineralogy I and II
Geo. 5330 Structural Geology
Geo 5331 Tectonics
Geo 5342 Chemical Phase Theory
Geo 5343 Igneous and Metamorphic Petrology
Geo 5350 Historical Geochemistry
Geo 5351 Sedimentary Geochemistry
Geo 5360, 5361 Sedimentology I and II
Geo 5370, 5371 Mineral Deposits I and II
Geo 5390 Pre-Cambrian Geology

Graduate Courses*

- Geology 67.504F1, W1, S1
Field Studies
Systematic investigations of geological problems based on a minimum of 15 days field work plus related library research and laboratory projects. Written report required.
J.A. Donaldson and other members of the Department.

- Geology 67.505T2
Mineral Economics
Principles of economics applied to the mineral industries. Special reference is made to the major mineral industries and to international resources, supply-demand, marketing, transportation, and financing. Economic geology of the more significant mineral industries.
Prerequisites: Geology 67.325 and Economics 43.100, or permission of the instructor.
R.L. Borden.

- Geology 67.514F1
Tectonophysics
The basic concepts of continuum mechanics applied to geodynamic problems: stress, strain, rheological equations, theories of elasticity, strength, plasticity, and linear and non-linear viscosity. Lectures and seminars on fundamentals and selected case histories.

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

Prerequisite: Graduate standing in geology or a related discipline, or permission of the instructor.
Giorgio Ranalli.

• Geology 67.525T2
Advanced Crystallography
Principles and techniques of X-ray crystallography; interpretation of X-ray photographs and application to the study of minerals.
Prerequisites: Geology 67.221 and 67.222.
G.Y. Chao.

• Geology 67.531F1, W1
Advanced Palaeontology
The morphology, classification, palaeoecology and geological history of one or more faunal or floral fossil groups. Normally the course stresses microfauna and microflora such as *Foraminifera*, *Ostracoda*, conodonts, spores, pollen and acritarchs, but arthropods (especially insects) and other macrofossils may also be included.
Prerequisites: Geology 67.335 and 67.431 may be taken concurrently; Biology 61.360 is recommended.
Kenneth Hooper and Jarmila Kukalova-Peck.

• Geology 67.534W1
Palynology and Microplankton
Modern and fossil pollen, spores, acritarchs, dinoflagellates and diatoms. Field and laboratory techniques of collection and preparation. Principles of pollen analysis; interpretation of pollen diagrams. The succession of microfloras and microfaunas. Laboratory: examination of palynomorphs.
Kenneth Hooper, I.L. Bayly and W.I. Illman.

• Geology 67.550T2
Advanced Petrology
Interpretation of metamorphic and igneous rocks, with emphasis on phase equilibria.
Prerequisites: Chemistry 65.210, Geology 67.451 and 67.452.
G.B. Skippen, D.H. Watkinson and Edgar Froese.

• Geology 67.562F1
Pre-Cambrian Geology I
Problems of Pre-Cambrian geology, emphasizing classical and current studies in North America; research projects, field trips, and petrologic studies of representative rock suites.
Prerequisite: One of Geology 67.451, 67.452, 67.463. (May be taken concurrently)
J.A. Donaldson.

• Geology 67.582W1
Isotope Geology
Application of isotopes to geologic problems. Review of the basic methods. Case histories. Age of the earth and meteorites. "Absolute" time scale. Stable isotopes: carbon, oxygen, sulphur. Fission track dating.
Prerequisite: Geology 67.325 or permission of the instructor.
Keith Bell.

• Geology 67.590T2, 67.591F1, W1
Directed Studies
Directed reading or directed laboratory studies for full or half-course credit under the guidance of selected extramural or intramural directors.

• Geology 67.599F4, W4, S4
M.Sc. Thesis

• Geology 67.699F16, W16, S16
Ph.D. Thesis

Courses Not Offered in 1978-79

67.515 Petrofabrics
67.520 Mineral Deposits
67.540 Tectonics Seminar
67.542 Advanced Structural Geology
67.545 Glaciology
67.560 Stratigraphy and Sedimentology
67.563 Pre-Cambrian Geology II
67.580 Advanced Inorganic Geochemistry
67.583 Physics of the Earth
67.585 Physical Geochemistry

Information and Systems Science Committee

The Committee

Chairman of the Committee: Frantisek Fiala

With the cooperation of the Department of Mathematics and the Department of Systems Engineering and Computing Science, the Committee offers programs of graduate study and research leading to the degree of Master of Science.

Within the program four areas of specialization exist:

- Information Systems Engineering
- Numerical and Non-Numerical Applications of Computers
- Computing Science
- Mathematical Systems Theory and Applications

Combining elements from the disciplines of mathematics, statistics, systems engineering, computing science, and electrical engineering, the program is oriented towards the high-level theorist/practitioner who is called upon to examine systems-related problems, frequently of an inter-disciplinary nature. Topics spanned by the four areas above include computer network design, mini/micro computer systems, data base systems, software development, theory of algorithms, dynamical systems, statistics and operations research. Close links are maintained with the scientific, industrial, and technological communities, and an effort is made to direct students to project work of current practical significance.

Qualifying Year Program

Applicants who have a general (pass) Bachelor's degree, or who otherwise lack the required undergraduate preparation, may be admitted to a Qualifying Year program. Refer to the general section of this Calendar for regulations governing the Qualifying Year.

Master of Science

Admission Requirements

Applicants should have an Honours bachelor's degree, or equivalent, with at least second-class standing, in mathematics, engineering, physics, chemistry, computing science, operations research, experimental psychology, econometrics, management science, or a related discipline. Undergraduate preparation should include at least two full courses in computing and a minimum of three full courses in mathematics, at least one of which is at the third-year level or higher. In addition, the student is required to have some knowledge of quantitative applications, such as numerical analysis, simulation, operations research, etc.

Admissions to the program will be made through one of the two participating departments. Since space and laboratory facilities will be provided by one of the departments, students should apply through the department with which they wish to be most closely associated.

Program Requirements

The normal program comprises eight half-courses and a thesis; additional requirements may also be stipulated, depending upon the individual student's background. With the approval of the Committee, students who have substantial work experience may be permitted to substitute three additional half-courses in place of the thesis.

Students must take at least one full course from each of the two participating departments as well as the joint course 70/94.582: Topics in Information Science. Each student should consult with his faculty adviser in the selection of a course pattern related to his principal area of interest.

Each candidate submitting a thesis will be required to undertake an oral examination on the subject of his thesis.

Course work may be completed on either a full-time or part-time basis. Thesis research normally requires full-time residence at the University. However, a candidate may be permitted to carry out thesis work off-campus

provided that suitable arrangements are made for supervision and experimental work, and prior approval is given by the Committee.

Graduate Courses*

Information and Systems Science

• Information and Systems Science 70/94.582 Topics in Information and Systems Science
The purpose of this course is to bring together fundamental results in the new and active area of design and analysis of efficient computer algorithms for large, complex problems. Areas of application include data manipulation, computer networks, queueing systems, and optimization.

Mathematics

Undergraduate Courses:
70.301 Real Analysis I
70.302 Real Analysis II
69/70.310 Modern Algebra
70.350 Mathematical Statistics
70.403 Functional Analysis
70.451 Probability Theory
70.452 Sampling Theory and Methods I
70.453 Regression Analysis
70.456 Non-Parametric Methods I
70.457 Testing of Hypotheses
70.458 Stochastic Models
70.470 Introduction to Partial Differential Equations
70.471 Selected Topics in Partial Differential Equations
70.473 Qualitative Theory of Ordinary Differential Equations
70.482 Introduction to Mathematical Logic
70.483 Topics in Applied Logic
70.485 Theory of Automata
70.486 Numerical Analysis
70.487 Game Theory
70.496 Directed Studies

Graduate Courses:
70.500 Analysis
70.510 General Algebra
70.552 Sampling Theory and Methods II
70.553 Analysis of Variance I
70.554 Stationary Stochastic Processes
70.555 Design of Experiments
70.556 Non-Parametric Methods II
70.557 Statistical Inference.
70.558 Stochastic Differential Equations
70.559 Multivariate Analysis
70.560 Combinatorial Optimization
70.570 Probability Theory
70.581 Linear Optimization
70.583 Nonlinear Optimization
70.584 Topics in Operations Research
70.585 Topics in Algorithm Design
70.586 Numerical Analysis
70.587 Formal Languages and Syntax Analysis
70.590 Seminar in Mathematics
70.591 Directed Studies
70.651 Statistical Methods in Operations Research
70.652 Advanced Design of Surveys

Systems Engineering and Computing Science

Undergraduate Courses:
94.303 Real-Time Computing Systems
95.401 Operating Systems
94.405 Discrete Simulation and Its Applications
94.451 Communication Systems
94.455 Automatic Control Systems I
94.456 Automatic Control Systems II
94.457 Introduction to the Architecture of Computer Systems
94.461 Programmable Logic Systems
94.466 Switching Circuits
94.480 Introduction to Software Engineering
94.481 Software Engineering Project

Graduate Courses:
94.501 Simulation and Modelling
94.504 Computer Methods in Industrial Engineering
94.505 Optimization Theory and Methods
94.515 Socioeconomic System Models
94.517 Queueing, Scheduling and Control of Information Systems
94.518 Topics in Information Systems
94.521 Computer Communication Systems I

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Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

94.524 Computer Communication Systems II
94.551 Estimation and Forecasting
94.552 Advanced Linear Systems
94.553 Stochastic Processes
94.554 Data Communications I
94.556 Advanced Stochastic Processes
94.557 Fundamentals of Discrete Systems
94.558 Digital Systems Architecture
94.562 Digital Signal Processing
94.563 Communications Technology
94.565 Data Communications II
94.567 Source Coding and Data Compression
94.571 Real-Time Systems
94.572 Topics in Software Engineering
94.573 Integrated Data Base Systems
94.574 Software Engineering
94.575 Software Translators and Their Applications
94.576 Computer System Performance Analysis
94.577 Teleprocessing Software Design
94.596 Directed Studies
70/94.598 Master's Thesis in Information and Systems Science

Because of the interdisciplinary nature of this area, a student will in some cases benefit by taking a third-year course as part of his program. In such a case it will be extra to the formal degree requirements, or else arrangements will be made to ensure that the subject matter is enriched through extra reading, etc.

Department of Mathematics

The Department

Chairman of the Department: L.D. Nel
Departmental Supervisor of Graduate Studies: B.M. Puttaswamaiah

The Department of Mathematics offers graduate programs leading to the M.Sc. degree with specialization in pure mathematics, applied mathematics, probability and statistics, and, in cooperation with the Department of Systems Engineering and Computing Science, a program leading to the M.Sc. degree in information and systems science; for details regarding this program, see page 114.

The Ph.D. degree is offered with specialization in pure mathematics, applied mathematics and probability and statistics.

The Department of Mathematics also offers a cooperative Master's program in statistics in collaboration with the federal government, emphasizing practical training through work experience along with sound training in statistical inference and basic probability theory.

The principal research interests of the faculty include the following fields:

Pure Mathematics
Algebra: group theory; theory of rings and modules; representation theory; universal algebra; ordered structures; homological algebra; categories; commutative algebra.

Analysis: inequalities; summability; generalized integral transform; functional analysis; function spaces and algebras; operator theory; measure theory; potential theory.

Geometry: non-Euclidean, projective and finite geometries; regular figures.

Number theory: asymptotic theory; finite fields; analytic number theory.

Topology: structures of continuous functions; categorical topology; fixed point theory: algebraic topology.

Applied Mathematics
Compressible fluids; shock waves; airfoil theory; diffusion and convection; magnetohydrodynamics; electromagnetic and diffraction theory; special functions; asymptotic expansions; kinetic theory of gases; upper atmosphere problems; dynamics of stellar systems; numerical analysis; mathematical foundations of computing science and operations research.

Probability and Statistics
Probability theory; stochastic processes; weak and strong laws of invariance principle; goodness of fit; characterizations; multivariate analysis; operations research; distribution theory; analysis of variance; estimation theory; non-parametric methods; experimental design; sampling theory; foundations of statistical inference.

Master of Science

Admission Requirements

The minimum requirements for admission to the Master's program are outlined in the general section of this Calendar. Applicants with a general (pass) Bachelor's degree may be admitted to a Qualifying Year program.

In addition, applicants may be required to write the Advanced Tests in Mathematics of the Graduate Record Examination.

Program Requirements

The two program options in mathematics are the following:

- four full courses and a thesis;
- five full courses, without a thesis.

Only *one* of 70.507, 70.516, 70.518, 70.526, 70.527, 70.528, 70.535, 70.536, 70.546, 70.551, 70.565, and 70.567 may be offered in fulfillment of the degree requirements. In addition, one course may be selected from those offered at the senior undergraduate (400) level.

At least one of the courses must be taken in a field other than the student's major field. Ordinarily this course should be at the 500 level but in certain cases this rule may be waived by the chairman of the Committee on Graduate Studies.

If a thesis is written, the candidate will be required to undertake an oral examination on the subject of his thesis.

Doctor of Philosophy

Admission Requirements

The minimum requirements for admission to the Ph.D. program are outlined in the general section of this Calendar.

Program Requirements

The course requirement is a minimum of three graduate courses and a suitable thesis. At least one of the courses must be chosen from those offered outside the candidate's major field.

Language requirements will be determined by the candidate's thesis advisory committee.

A comprehensive examination will be undertaken in the following areas:

- the candidate's general area of specialization at the Ph.D. level;
- a basic examination based on analysis and algebra.

The format of the comprehensive examination will be determined by the candidate's advisory committee, but will normally consist of written and oral sections. This examination must be completed successfully within 18 months of admission into the Ph.D. program in the case of a full-time student, and within 36 months of admission in the case of a part-time student.

All Ph.D. candidates are also required to undertake a final oral examination on the subject of their thesis.

Selection of Courses

The following undergraduate courses may, with the approval of the Department of Mathematics, be selected by Master's candidates in partial fulfillment of their degree requirements:

Mathematics

70.401 Vector Calculus
70.403 Functional Analysis
70.407 Measure Theory
70.415 Rings and Modules
70.416 Group Theory
70.417 Commutative Algebra
70.418 Homological Algebra and Category Theory
70.425 Introduction to General Topology
70.426 Introduction to Algebraic Topology
70.427 Foundations of Geometry
70.428 Differential Geometry
70.435 Analytic Number Theory
70.436 Algebraic Number Theory
70.445 Analytical Dynamics
70.446 Hydrodynamics
70.447 Tensor Analysis and Relativity Theory
70.448 Introduction to Electromagnetic Theory
70.450 Parametric Estimation
70.451 Probability Theory
70.452 Sampling: Theory and Methods I
70.453 Regression Analysis
70.456 Non-Parametric Methods I
70.457 Testing of Hypotheses
70.458 Stochastic Models
70.470 Introduction to Partial Differential Equations
70.471 Selected Topics in Partial Differential Equations
70.472 Integral Transforms
70.473 Qualitative Theory of Ordinary Differential Equations
70.476 Special Functions
70.482 Introduction to Mathematical Logic
70.483 Topics in Applied Logic
70.485 Theory of Automata
70.486 Numerical Analysis
70.487 Game Theory

Graduate Courses*

- Mathematics 70.500T2

Analysis

Set theory, metric and topological spaces, linear spaces and functional analysis, distributions, operators, introductory spectral theory, measure and integral.

Prerequisites: Mathematics 70.301 and 70.302, familiarity with metric spaces and general

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The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

mathematical ideas at fourth-year level.
Arthur Smith and Graham Zelmer.

• Mathematics 70.501W1
Abstract Measure Theory
Abstract measure and integral, L-spaces, complex measures, product measures, differentiation theory, Fourier transforms.
Prerequisite: Mathematics 70.407.
L.E. May.

• Mathematics 70.502F1
Distributions and Generalized Functions
Linear topological spaces, countably multinormed spaces, countable union spaces and their duals, testing function spaces, spaces of generalized functions and their structure, Schwartz distributions, calculus of distribution, convolution, analytic representation and Fourier transform of distributions.
Prerequisite: Mathematics 70.403.

• Mathematics 70.503F1
Banach Algebras
Commutative Banach algebras; the space of maximal ideals; representation of Banach algebras as function algebras and as operator algebras; the spectrum of an element; special types of Banach algebras; for example, regular algebras, algebras with involution; applications.
Graham Zelmer.

• Mathematics 70.504W1
Integral Equations
A survey of the main results in the theory of non-singular linear integral equations; Volterra and Freedholm equations of first and second kind in the L_2 case, with special results for the continuous case; Hermitian kernels; eigenfunction expansions; compact operators.
Prerequisites: Mathematics 70.302 and 70.403.
C.E. Hughes.

• Mathematics 70.505F1
Complex Analysis
Complex differentiation and integration, harmonic functions, maximum modulus principle, Runge's theorem, conformal mapping, entire and meromorphic functions, analytic continuation.
W.J. Schneider.

• Mathematics 70.507F1
Measure Theory
Measure theory and integration of real-valued functions.
Prerequisite: Mathematics 70.302 or permission of the Department.

• Mathematics 70.509F1
Introduction to Hilbert Space
Geometry of Hilbert Space, spectral theory of linear operators in Hilbert Space.
Prerequisites: Mathematics 70.301, 70.302 and 70.403.
C.E. Hughes.

• Mathematics 70.510T2, S2
General Algebra
Algebraic structures, universal algebras, lattices, direct decompositions, operator groups and rings, algebraic constructions, ordered groups and rings, normed algebras, topological groups and rings.
Maurice Chacron and Vlastimil Dlab.

• Mathematics 70.511T2
Theory of Groups
Abelian groups, solvable and nilpotent groups, free groups and free products, structure of finite groups, linear groups, simple groups.
J.C. Poland, Luis Ribes and J.D. Dixon.

• Mathematics 70.512T2
Group Representations and Applications
An introduction to group representations and character theory with selected applications.
J.D. Dixon and B.M. Puttaswamaiah.

• Mathematics 70.513T2
Rings and Modules
Generalizations of the Wedderburn-Artin theorem and applications, homological algebra.
Maurice Chacron, Vlastimil Dlab, and B.M. Puttaswamaiah.

• Mathematics 70.515T2
Topological Groups
General topological groups, subgroups and factor groups, local properties. Haar integral, Lie groups.
M.J. Moore and Luis Ribes.

• Mathematics 70.516W1
Group Theory
Fundamental principles as applied to abelian,

nilpotent, solvable, free, and finite groups; representations.
Prerequisite: Mathematics 70.310 or permission of the Department.

• Mathematics 70.518W1
Homological Algebra and Category Theory
Axioms of set theory; categories, functors, natural transformations; free, projective, injective and flat modules; tensor products and homology functors, derived functors; dimension theory.
Prerequisite: Mathematics 70.310 or permission of the Department.

• Mathematics 70.520T2
Topology
General topology, homotopy theory, the fundamental group, complexes, differentiable manifolds, homology theory.
Prerequisites: Mathematics 70.301, 70.302, 70.310.
Luis Nel and H.H. Schirmer.

• Mathematics 70.521T2
Topics in Foundations of Geometry
Various axiom systems of geometry. Detailed examinations of at least one modern approach to foundations, with emphasis upon the connections with group theory.
Prerequisite: Permission of the Department.
C.W.L. Garner.

• Mathematics 70.522F1
Homology Theory
The Eilenberg-Steenrod axioms and their consequences, singular homology theory, applications to topology and algebra.
Prerequisite: Mathematics 70.425.
H.H. Schirmer and I.S. Pressman.

• Mathematics 70.526W1
Introduction to Algebraic Topology
Two-dimensional manifolds, homotopy, the fundamental group, covering spaces, CW-complexes.
Prerequisite: Mathematics 70.310 and 70.425 or permission of the Department.

• Mathematics 70.527F1
Foundations of Geometry
A study of at least one modern axiom system of Euclidean and non-Euclidean geometry, embedding of hyperbolic and Euclidean geometries in the projective plane, groups of motions, models of non-Euclidean geometry.
Prerequisite: Mathematics 70.310 (may be taken concurrently) or permission of the Department.

• Mathematics 70.528F1
Differential Topology
A study of differential manifolds, dealing with topics such as smooth mappings, transversality, intersection theory, vector fields on manifolds, differential forms, integration on manifolds, de Rham cohomology, Riemannian manifolds.
Prerequisite: Mathematics 70.425 or permission of the Department.

• Mathematics 70.530T2
Methods of Number Theory
Introduction to the Hardy-Littlewood method, sieve methods of Brun and Selberg, character sums.
Prerequisite: Mathematics 70.435.
K.S. Williams.

• Mathematics 70.532T2
Algebraic Number Theory
Valuations, local fields, algebraic number fields, class number, unit theorem, extension of number fields, ramification theory, quadratic and cyclotomic fields.
Prerequisite: Mathematics 70.436.
K.S. Williams.

• Mathematics 70.535F1
Analytic Number Theory
Dirichlet series, characters, Zeta-functions, prime number theorem, Dirichlet's theorem on primes in arithmetic progressions, binary quadratic forms.
Prerequisite: Mathematics 70.307 or permission of the Department.

• Mathematics 70.536W1
Algebraic Number Theory
Algebraic number fields, bases, algebraic integers, integral bases, arithmetic in algebraic number fields, ideal theory, class number.
Prerequisite: Mathematics 70.310 or permission of the Department.

• Mathematics 70.540T2
Advanced Classical Mechanics
Hamiltonian dynamics; integral invariants;

non-holonomic systems; rigid body motions.
Prerequisite: Mathematics 70.445.
Mizanur Rahman.

• Mathematics 70.541T2
Kinetic Theory of Gases and Plasmas
Irreversible processes in gases; Boltzmann and Fokker-Planck equations; theories of Bogoliubov and of Frieman and Sandri; inhomogeneous plasmas; initial and boundary value problems of gases and plasmas; the hydrodynamic stage.
Prerequisite: Mathematics 70.445.
Arthur Smith.

• Mathematics 70.543T2
Mathematical Methods in Fluid Dynamics
Peturbation methods in viscous and inviscid flow. Solutions of inviscid, unsteady and steady subsonic and supersonic flow problems. Hodograph methods. Characteristic coordinates. Shock waves; rarefaction waves; interaction problems.
Prerequisite: Mathematics 70.446 or permission of the Department.
Paul Mandl and E.J. Norminton.

• Mathematics 70.545T2
Wave Propagation and Diffraction Theory
Mathematical treatment of wave propagation; scalar and vector waves; the diffraction phenomenon; the general diffraction problem; the solvable problems; the Kirchoff-Huygens diffraction theory; applications to microwave lenses and interferometer theory.
Prerequisite: Mathematics 70.448.
F.H. Northover.

• Mathematics 70.546F1
Introduction to Partial Differential Equations
First order linear, quasi-linear, and non-linear equations; second order equations in two or more variables; systems of equations; the wave equation; Laplace's and Prisson's equations; Dirichlet and Neumann problems; Green's functions.
Prerequisite: Mathematics 70.302 or 70.307 and 70.308, or permission of the Department.

• Mathematics 70.547W1
Topics in Partial Differential Equations
Theory of distributions, initial-value problems based on two-dimensional wave equations, Laplace transform, Fourier integral transform, diffusion problems, Helmholtz equation with application to boundary and initial-value problems in cylindrical and spherical coordinates.
Prerequisite: Mathematics 70.546 or permission of the Department.

• Mathematics 70.550F1
Multivariate Normal Theory
Multivariate normal distribution-properties, characterization, estimation of means and covariance matrix. Regression approach to distribution theory of statistics. Multivariate tests. Correlations. Classification of observations. Wilks' criteria.
Prerequisite: Mathematics 70.350.
D.K. Dale and Ehsanes Saleh.

• Mathematics 70.551W1
Testing of Hypotheses
Confidence interval, fiducial interval, Bayesian interval, most powerful test, uniformly most powerful test, power function, minimal sufficiency, complete statistic, similar regions, unbiased test, likelihood ratio test.
Prerequisite: Mathematics 70.450 or permission of the Department.

• Mathematics 70.552W1
Sampling Theory and Methods II
Ratio and regression estimation theory; unequal probability sampling; multi-stage sample designs; two-phase sampling; interpenetrating samples; domains of study; nonsampling errors; related topics.
Prerequisite: Mathematics 70.452 or permission of the Department.
J.E. Graham and J.N.K. Rao.

• Mathematics 70.553F1
Analysis of Variance I
The basic mathematical theory of the analysis of variance; mathematical models; estimable functions; Gauss-Markov theorems; confidence ellipsoids; tests of hypotheses; the one-way and some higher-way layouts; analysis of covariance.
Prerequisites: Mathematics 70.450 and 70.453 or permission of the Department.
D.K. Dale, A.B.M.L. Kabir and Ehsanes Saleh.

• Mathematics 70.554F1
Stochastic Processes and Time Series Analysis
Stationary stochastic processes, inference for

stochastic processes, applications to time series and spatial series analysis.
Prerequisites: Mathematics 70.451 or permission of the Department.
D.A. Dawson.

• Mathematics 70.555W1
Design of Experiments
Interpretation of factorial experiments; confounding; fractional replication; split plot, split block, Latin square, Graceo-Latin square, lattice and incomplete block designs; response surface techniques.
Prerequisite: Mathematics 70.553 or permission of the Department.
J.N.K. Rao.

• Mathematics 70.556W1
Non-Parametric Methods II
Replacing composite hypotheses by equivalent simple ones; several-sample problem, locally most powerful test; method of obtaining rank tests; asymptotic distribution of linear rank statistics, power and efficiency of non-parametric tests.
Prerequisite: Mathematics 70.456 or permission of the Department.
Miklos Csörgö and Ehsanes Saleh.

• Mathematics 70.557W1
Statistical Inference
Pure significance tests; uniformly (or locally) most powerful tests; likelihood ratio tests; tests of fit; asymptotic comparisons of tests; likelihood, Bayesian and empirical Bayesian methods; fiducial and structural arguments.
Prerequisite: Mathematics 70.450 or permission of the Department.
J.N.K. Rao and Peter Tan.

• Mathematics 70.558F1
Topics in Stochastic Processes
Course contents will vary, but will include topics drawn from Markov processes. Brownian motion, stochastic differential equations, martingales, Markov random fields, random measures and infinite particle systems, advanced topics in modelling; population models, etc.
Prerequisites: Mathematics 70.356 and 70.451 or permission of the Department.
D.A. Dawson.

• Mathematics 70.559F1
Multivariate Analysis
Multivariate methods of data analysis, including principal components, cluster analysis, factor analysis, canonical correlation, MANOVA, profile analysis, discriminant analysis, path analysis.
Prerequisite: Mathematics 70.450 or permission of the Department.
J.E. Graham and J.N.K. Rao.

• Mathematics 70.565F1
Theory of Automata
Algebraic structure of sequential machines, decomposition of machines; finite automata, formal languages; complexity.
Prerequisite: Mathematics 70.210 or permission of the Department.

• Mathematics 70.567F1
Game Theory
Two-person zero-sum games; infinite games; multi-stage games; differential games; utility theory; two-person general-sum games; bargaining problem; n-person games; games with a continuum of players.
Prerequisite: Mathematics 70.301 or permission of the Department.

• Mathematics 70.569F1
Topics in Combinatorial Mathematics
Prerequisite: Permission of the Department.

• Mathematics 70.570T2
Probability Theory
Axioms, expectation and integration; zero-one law; Borel-Cantelli lemma; Kolmogorov's extension theorem; convergence concepts, laws of large numbers, characteristic functions; weak convergence; invariance principle, Brownian motion; Markov chains, conditional expectation, martingales.
Prerequisites: Mathematics 70.301, 70.302, 70.407.
Miklos Csörgö, D.A. Dawson and Roger Fischler.

• Mathematics 70.581F1
Linear Optimization
Linear programming problems; simplex method, upper bounded variables, free variables; duality; postoptimality analysis; integer programming problems; unimodularity, network flows; transportation and assignment problems; shortest

path problems; knapsack problem.
Prerequisites: A course in linear algebra and permission of the Department.
W.H. Cunningham and Frantisek Fiala.

• Mathematics 70.582W1
Topics in Information and Systems Science
The purpose of this course is to bring together fundamental results in the new and active area of design and analysis of efficient computer algorithms for large, complex problems. Areas of application include data manipulation, computer networks, analysis, queueing systems, optimization, etc.
(Also offered as Engineering 94.582)
R.J.A. Buhr and Frantisek Fiala.

• Mathematics 70.583W1
Nonlinear Optimization
Methods for unconstrained and constrained optimization problems; Kuhn-Tucker conditions; penalty functions, duality; quadratic programming; geometric programming; separable programming; integer non-linear programming; pseudo-Boolean programming; dynamic programming.
Prerequisite: Permission of the Department.
W.H. Cunningham and Frantisek Fiala.

• Mathematics 70.584F1, W1, S1
Topics in Operations Research

• Mathematics 70.585F1, W1, S1
Topics in Algorithm Design

• Mathematics 70.586W1
Numerical Analysis
Error analysis for fixed and floating point arithmetic; systems of linear equations; eigenvalue problems; sparse matrices; interpolation and approximation, including Fourier approximation; numerical solution of ordinary and partial differential equations.
Prerequisite: Permission of the Department.

• Mathematics 70.587W1
Formal Language and Syntax Analysis
Context-free languages; ambiguity; the parsing problem; parallel top-down and bottom-up methods; backtrack and n-backtrack methods and suitable languages; LR (k), bounded-context and precedence grammars, relation to automata.
Prerequisite: Mathematics 70.485 desirable; permission of the Department.
Frantisek Fiala.

• Mathematics 70.588F1
Combinatorial Optimization
Network flow theory and related material. Topics will include shortest paths, minimum spanning trees, maximum flows, minimum cost flows. Optional matching in bipartite graphs.
Prerequisite: Permission of the Department.
W.H. Cunningham.

• Mathematics 70.589W1
Combinatorial Optimization
Topics include optimal matching in non-bipartite graphs, Euler tours and the Chinese Postman problem. Other extensions of network flows: dynamic flows, multicommodity flows, and flows with gains. Bottleneck problems. Matroid optimization. Enumerative and heuristic algorithms for the Travelling Salesman and other "hard" problems.
Prerequisite: Mathematics 70.588.
W.H. Cunningham.

• Mathematics 70.590T2
Seminars in Mathematics

• Mathematics 70.591F1, W1, S1
Directed Studies

• Mathematics 70.599F2, W2, S2
M.Sc. Thesis

• Mathematics 70.601W1
Topological Vector Spaces
Construction of new topological vector spaces out of given ones. Local convexity and the Hahn-Banach theorem. Compactness and the Krein-Milman theorem. Conjugate spaces, polar sets.
Prerequisite: Mathematics 70.403.
Graham Zelmer.

• Mathematics 70.602W1
Harmonic Analysis on Groups
Transformation groups; Haar measure; unitary representations of locally compact groups; completeness and compact groups; character theory; decomposition.
B.M. Puttaswamaiah.

• Mathematics 70.603W1
Applications of Generalized Functions
Generalized integral transforms; Laplace, Mellin, Hankel, Weierstrass, K- and Convolution transforms; generalized solutions of partial differential equations; further applications.
Prerequisite: Mathematics 70.502.
J.N. Pandey.

• Mathematics 70.608F1
Topics in Analysis

• Mathematics 70.609W1
Topics in Analysis

• Mathematics 70.610T2
Universal Algebra
Concept of a universal algebra; homomorphisms, kernels of homomorphisms, decomposition of homomorphisms; free word algebras and some of their properties; free algebras within classes of algebras; constructions of free members; equationally definable classes; polarity.
Vlastimil Dlab.

• Mathematics 70.611T2
Selected Topics in Group Theory

• Mathematics 70.612T2
Category Theory
Categories and functors. Limits. Adjoint functors. Triples and algebras. Abelian categories. Homological algebra.
I.S. Pressman.

• Mathematics 70.613T2
Selected Topics in Ring Theory
Maurice Chacron and Vlastimil Dlab.

• Mathematics 70.621F1
Topics in Topology

• Mathematics 70.622W1
Topics in Topology

• Mathematics 70.643T2
Mathematical Theory of Hypersonic Flow
Basic equations of inviscid, unsteady hypersonic flow. Small disturbance theory, Newtonian theory. Optimum body shapes. Blunt-body theory. Hypersonic flow past oscillating wedges and cones. Hypersonic boundary layers.
Prerequisite: Mathematics 70.543 or permission of the Department.
Paul Mandl.

• Mathematics 70.651F1
Statistical Methods in Operations Research
Dynamic programming; modelling of physical systems by Markov chains; sequential inference problems; adaptive control processes; the principle of optimality; dynamic programming under uncertainty.
Prerequisites: Mathematics 70.356 and 70.451 or permission of the Department.
D.A. Dawson and Roger Fischler.

• Mathematics 70.652W1
Advanced Design of Surveys
Foundations of survey sampling; maximum likelihood and Bayesian estimation; super population and random permutation models; multiple frame theory; analytical surveys; related topics.
Prerequisite: Mathematics 70.552 or permission of the Department.
J.N.K. Rao.

• Mathematics 70.657F1
Topics in Probability and Statistics

• Mathematics 70.658F1
Topics in Probability and Statistics

• Mathematics 70.690T2
Seminars in Mathematics

• Mathematics 70.691F1, W1, S1
Directed Studies

• Mathematics 70.699F, W, S
Ph.D. Thesis

The Department

Chairman of the Department: M.K. Sundaresan
Departmental Supervisor of Graduate Studies: Lazer Resnick

The Department of Physics offers programs of study and research leading to the M.Sc. and Ph.D. degrees.

At the M.Sc. level, the Department offers programs of study in the areas of research interest outlined below, in addition to a program in applied nuclear physics with orientation towards reactor physics.

The Ph.D. program specializes in high energy physics and in some aspects of intermediate energy physics (muonic atoms), both experimental and theoretical.

Some of the research in the fields outlined below is being carried out in collaboration with institutions such as the National Research Council, the University of Chicago, Argonne National Laboratory, Fermilab, TRIUMF, and others. The current research interests of the Department are the following:

Theoretical Physics
Elementary particle physics; field theory, nuclear physics; statistical mechanics (kinetic theory);

Intermediate Energy Physics
Muonic atoms, both atomic and nuclear aspects;

High Energy Physics
Study of elementary particle properties and interactions using major high energy accelerators; research in new instrumentation techniques (for example, streamer chambers, wire spark chambers, transition radiation detectors, etc.);

Medical Physics
Radiography—the uses of external γ-rays for density measurement and for imaging of internal structures in medical diagnosis and industrial applications;

Geochronology
Mass spectrometry, isotope geology; Rubidium-Strontium age determinations; isotopic abundance measurements, isotopic analysis of solids and gases;

Laser Physics
Development work in transversely excited high-pressure carbon dioxide lasers, stressing the application of short high-voltage pulses to the discharge.

Master of Science

Admission Requirements

The normal requirement for admission is an Honours bachelor's degree with at least second-class standing in physics or a related discipline. Refer to the general section of this Calendar for further details regarding admission requirements.

Program Requirements

Each candidate will choose one of the following optional program patterns:

- three full courses (of which at least two must be in physics and two must be at the 500 level) and a thesis equivalent to two full courses, which must be defended at an oral examination;
- four full courses (of which at least two must be in physics and three must be at the 500 level) and a thesis equivalent to one full course, which must be defended at an oral examination;
- Five full courses (of which at least three must be in physics and four must be at the 500 level); one of these courses must be Physics 75.590. The candidate must also pass a final comprehensive examination (written or oral, or both).

All candidates except those specializing in applied nuclear physics are normally expected to select and complete successfully either Physics 75.571 or 75.572.

Candidates in the area of applied nuclear physics (reactor physics) are normally expected to take and complete successfully Physics 75.553 and 75.554. One of the courses in this program must be Physics 75.590. The other three full (or six half-) courses must be selected from a list of courses in physics, engineering or mathematics in consultation with the supervisor of graduate studies.

All candidates are also expected to attend and participate in Departmental seminars and colloquia.

Language requirements, prescribed to meet the needs of each student, will be determined by the candidate's supervisor.

Doctor of Philosophy

Admission Requirements

Applicants for admission into the Ph.D. program must ordinarily have a Master's degree in physics or a related discipline.

An applicant with an Honours bachelor's degree who has achieved an outstanding academic record and, in addition, exhibits very strong motivation and high promise for advanced research, may be admitted to the Ph.D. program directly. Such candidates will be required to complete at least 15 full courses, or the equivalent.

Students who have been admitted to the Master's program may be permitted to transfer into the Ph.D. program if they show outstanding academic performance and demonstrate high promise for advanced research during the first year of the Master's program.

Admission to the Ph.D. program is provisional, subject to satisfactory passing of a qualifying examination, which is set soon after entry.

Program Requirements

The minimum program requirements for the Ph.D. degree in physics are the following:

- ten full courses (or the equivalent) of which at least one non-thesis course must be at the 600 level in physics;
- a thesis equivalent to approximately one-half of the total course requirement, to be defended at an oral examination;
- a comprehensive examination (written and oral) which normally will be completed prior to starting the Ph.D. thesis research;
- language requirements, as determined by the candidate's supervisor;
- attendance and participation in Departmental seminars and colloquia.

Students who have been admitted to the Ph.D. program on the basis of a 15-course requirement, which normally will require three years of full-time study, must complete the following:

- 15 full courses or the equivalent;
- a comprehensive examination;
- a research thesis equivalent to a maximum of eight of the 15-course requirement;
- the language requirement outlined above.

Selection of Courses

The following senior undergraduate courses are approved for selection by graduate students in the Department:

Physics
75.477 Introduction to Quantum Mechanics I
75.478 Introduction to Quantum Mechanics II: Applications

Graduate Courses*

Graduate students may register in the following courses, subject to the approval of the Department of Physics:

- Physics 75.511F1
Classical Mechanics and Theory of Fields
Hamilton's principle. Conservation laws. Canonical transformations. Hamilton-Jacobi theory. Lagrangian formulation of classical field theory.

- Physics 75.522W1
Molecular Spectroscopy
Spectra of simple molecules. Brief survey of atomic spectroscopy. Rotations and vibrations of diatomic and polyatomic molecules and the methods of obtaining information about the geometrical structure of the molecule and the forces acting between the constituent particles from the observed rotation and vibration spectra. Electronic structure of molecules as

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derived from a study of electronic spectra based mainly on molecular orbital theory. The description will be from the point of view of the experimentalist rather than the theorist. (Also offered as Chemistry 65.509)
Prerequisite: Physics 75.477 or Chemistry 65.310.

• Physics 75.541F1
Fundamental Principles of Statistical Mechanics
Postulates of classical statistical mechanics; microcanonical, canonical and Grant canonical ensembles; fluctuations. Postulates of quantum statistical mechanics; density matrix; ensembles in quantum statistical mechanics. Darwin Fowler method. Equations of state for ideal classical, Fermi and Bose gases. Imperfect gases. Phase transitions; theory of Lee and Yang; Ising model; Onsager solution.
Prerequisites: Physics 75.477, 75.478 and 75.511.

• Physics 75.553F1
Reactor Physics I
Brief review of orthogonal coordinate systems; divergence, Laplacian etc., in various coordinate systems; continuity equation; flow equations (heat, current, neutrons); diffusion of thermal neutrons (collisional energy transfer, scattering probability, statistical energy degradation); Fermi age-velocity theory; fast neutron flow equation; thermal multiplication pile; criticality criteria; solutions of flow and continuity equations: heat flow (various geometries and boundary conditions), neutron flow (moderation by graphite block).
Prerequisites: Physics 75.381, 75.386 or permission of the Department.

• Physics 75.554W1
Reactor Physics II
Nuclear reactions, binding energy, resonance. Fission, products, energy release, cross sections, neutron multiplication, delayed neutrons. Reactors, criticality, size, fuel distribution, flux distribution. Stability, time constant, poisoning, control systems. Fuel cycles, fertile and fissile materials. Breeding, near breeders, fuel sources, fabrication, handling. Heat transfer and mechanical design. Safety, waste disposal, hazards. Grid systems, counter arguments, other sources. Isotope production.
Prerequisite: Physics 75.553 or permission of the Department.

• Physics 75.561F1
Experimental Techniques of Nuclear and Elementary Particle Physics
The interaction of radiation and high energy particles with matter. Experimental methods of detection and acceleration of particles. Use of relativistic kinematics. Counting statistics. Beam optics.
Prerequisites: Physics 75.437, 75.468 and 75.477, 75.478.

• Physics 75.562W1
Physics of Elementary Particles
Description of properties of elementary particles; pions, kaons and baryons. Conservation laws, invariance principles and quantum numbers. Resonances observed in final state interactions. Three body phase space; Dalitz plot. SU_3 symmetry scheme for classifying elementary particles, mass formulae and electromagnetic mass differences. Weak interactions; decay of neutral kaons; CP violation in neutral K decays.
Prerequisite: Physics 75.477.

• Physics 75.564W1
Intermediate Nuclear Physics
Properties of the deuteron and the neutron-proton force. Nucleon-nucleon forces, isospin and charge independence. Nuclear models: Single particle shell model, shell model with interactions, pairing, quasi-particles, collective models, deformed shell model. Scattering theory: effective range theory, partial wave analysis, phase shifts. Interpretation of n-p and p-p scattering experiments. Interaction of nucleons with electrons. Interaction of nuclei with radiation: Multipole fields, transition rates, selection rules, internal conversion.
Prerequisite: Physics 75.561.

• Physics 75.571F1
Intermediate Quantum Mechanics with Applications
Review of the basic postulates of quantum mechanics; applications of quantum mechanics to nonrelativistic system—atoms, molecules and nuclei. Scattering theory; applications. Dirac's one particle theory.
Prerequisites: Physics 75.477 and 75.478.

• Physics 75.572W1
Relativistic Quantum Mechanics
Relativistic wave equations. Expansion of S matrix in Feynman perturbation series. Feynman rules. An introduction to quantum electrodynamics without second quantization.
Prerequisite: Physics 75.571.

• Physics 75.582W1
Methods of Theoretical Physics II
This is a continuation of Physics 75.581. Topics include group theory, discussion of SU_2, SU_3 and other symmetry groups. Lorentz group. Integral equations and eigenvalue problems.

• Physics 75.590T2
Selected Topics in Physics (M.Sc. level)
A student may, with the permission of the Department, take more than one selected topic, in which case each full course in Physics 75.590 will be counted for credit. Not more than one selected topic may be counted for credit in any one academic year.

• Physics 75.599F, W, S
M.Sc. Thesis

• Physics 75.671F1
Quantum Electrodynamics
Relativistic quantum field theory; second quantization of Bose and Fermi fields. Reduction and LSZ formalism. Perturbation expansion and proof of renormalizability of quantum electrodynamics. Calculations of radiative corrections and applications.
Prerequisites: Physics 75.511, 75.532, 75.571 and 75.572.

• Physics 75.672W1
Selected Topics in Quantum Field Theory
Topics of current interest, such as unified field theories of electromagnetic and weak interactions, renormalization problems, etc., will be treated. Scale invariance, light cone singularities of current commutators; current algebras, sum rules.
Prerequisite: Physics 75.671.

• Physics 75.690T2
Selected Topics in Physics (Ph.D. level)

• Physics 75.699F, W, S
Ph.D. Thesis

Courses Not Offered in 1978-79

75.532 Classical Electrodynamics
75.581 Methods of Theoretical Physics I
75.660 Advanced Nuclear Physics
75.663 Topics in Elementary Particle Physics Phenomenology

Departmental Program Descriptions and Details of Courses

Faculty of Social Sciences

Dean: T.J. Ryan

The School

Director of the School: J.B. Waugh

The School of Commerce does not offer a graduate program. Graduate courses are offered in collaboration with the School of Public Administration; members of the School also supervise graduate research.

Graduate Courses*

• Accounting 41.510F1
Management Accounting
An introduction to the underlying assumptions and basic principles of accounting, and an examination of the uses of accounting information by management. Topics include income measurement, asset valuation, financial statement analysis, cost systems, control reports, operating budgets, capital expenditure decisions and alternative choice problems.
(Also offered as Administration 50.510)
A.G. Blair.

• Management Studies 42.511W1
Financial Management
An examination of the principles and practice of financial planning and control. Analysis of the problems of resource allocation and asset management under conditions of uncertainty. Techniques of capital expenditure analysis and analysis of funds flow.
(Also offered as Administration 50.511)
Prerequisite: Accounting 41.510 (Administration 50.510) or permission of the instructor.
Eldon Gardner and Steven Diener.

• Management Studies 42.518W1
Marketing for Non-Profit Organizations
Examination of the concepts of marketing relative to public demand, and the market for social goods and services. Contemporary marketing approaches and practices are analyzed and applied to purposes, programs, and environments of government agencies and departments, educational institutions, charities, and other public and social services.
J.A. Barnhill.

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Department of Economics

The Department

Chairman of the Department: J.F. Chant
Departmental Supervisors of Graduate Studies: A.L.K. Acheson and S.B. Park

The Department of Economics offers programs of study and research leading to the M.A. and Ph.D. degrees.

Graduate students in economics undertake a thorough review of economic theory, together with an analysis of the Canadian economy, its institutions and history, and the working of public policy. Stress is placed on the understanding and application of quantitative methods to all aspects of economics. Although the programs are generally oriented towards policy problems, there is considerable opportunity for the development of specialized interests.

The main areas of specialization within the Department include the following:
Industrial Organization
Public Finance
Money and Trade
Urban and Regional Economics
Economic Theory
Quantitative Methods

Qualifying Year Program

Applicants who have a general (pass) Bachelor's degree, or who otherwise lack the required undergraduate preparation, may be admitted to a Qualifying Year program designed to raise their standing to Honours status. If successful, they may be permitted to proceed to the Master's program the following year.

Refer to the general section of this Calendar for details of the regulations governing the Qualifying Year.

Master of Arts

Admission Requirements

The normal requirement for admission to the Master's program is an Ontario Honours B.A. (or the equivalent) in economics, with at least second-class standing.

Applicants are expected to have had an adequate preparation in statistics and mathematics. Credit in the following two undergraduate courses (or their equivalents) will be accepted: Economics 43.220, Statistical Methods in the Social Sciences; and Mathematics 69.107, Elementary Calculus and 69.127, Topics in Calculus and Algebra. Students who do not satisfy the statistics requirement will be asked to take Economics 43.592: Empirical Methods, prior to proceeding to Economics 43.505: Econometrics. Students with inadequate mathematical backgrounds will be required to enroll in 43.593: Mathematics for Economists.

The Department may require certain applicants to write the Graduate Record Examination Aptitude Test and the Advanced Test in Economics offered by the Educational Testing Service.

Program Requirements

All Master's students in Economics are required to complete the following courses:

Economics
43.501 Advanced Micro-Economic Theory
43.502 Advanced Macro-Economic Theory
43.505 Econometrics
43.598 M.A. Tutorial

The tutorial serves to prepare candidates for the requirement of completing a written M.A. comprehensive examination. Details of this examination are outlined below.

In addition, each candidate must select and complete one of the following:
- a thesis, equivalent to one and one-half credits and approved course(s) for one credit;
- approved courses for two and one-half credits, one of which may be selected from among those offered in a related discipline with special permission from the Departmental supervisors of graduate studies.

Comprehensive Examinations

Master's candidates in economics must undertake a written comprehensive examina-

tion to demonstrate their knowledge of economic theory and its policy implications.

There may also be an optional oral examination designed to give the student an opportunity to expand on the answers and solutions submitted in the written parts.

Academic Standing

A grade of B- or better must normally be obtained in each course counted towards the Master's degree. A candidate may, with the recommendation of the Department, be allowed a grade of C+ or C (but not C–) in one full course or each of two half-courses.

Doctor of Philosophy

The Ph.D. program is principally concerned with Canadian economic policy.

The course content of the program must be undertaken on a full-time basis; completion of the overall Ph.D. requirements entails a minimum of two years of study.

Admission Requirements

The normal requirement for admission into the Ph.D. program is a Master's degree (or the equivalent) from a recognized university.

The Department may require certain applicants to write a comprehensive entrance examination.

Program Requirements

Ph.D. candidates are expected to have or acquire proficiency in mathematics and statistics. This requirement must be satisfied before proceeding with the program.

Doctoral candidates would usually complete:

Economics
43.600 Economic Theory I: Microeconomics
43.601 Economic Theory II: Macroeconomics
43.602 Analysis of Microeconomic Policy
43.603 Analysis of Macroeconomic Policy
43.606 Economic Models and Policy Applications
43.611 Workshop in Economic Policy

- Four other graduate half-courses (or the equivalent) in economics; with the permission of the Departmental supervisors of graduate studies, one full course may be selected from a related discipline.
- a formal dissertation, equivalent to five full course credits, which must be defended at an oral examination;
- three written comprehensive examinations (theory, policy, and an optional field).

Academic Standing

Doctoral students must normally obtain a grade of B– or better in each course counted towards the degree.

Qualifying Year Courses*

- Economics 43.590F1
Microeconomic Theory
This course is required for Qualifying Year students whose preparation in microeconomic theory is judged to be inadequate.
R.L. Carson.

- Economics 43.591W1
Macroeconomic Theory
This course is required for Qualifying Year students whose preparation in macroeconomic theory is judged to be inadequate.
Elmer Wiens.

- Economics 43.592F1
Empirical Methods
Principles of statistical theory, probability, testing and introduction to regression analysis. Designed for those judged deficient in undergraduate statistical training.
D.G. McFetridge.

- Economics 43.593F1
Mathematics for Economists
This course provides an introduction to the use of mathematical techniques in economics. Topics in optimization such as Lagrangean multipliers and second order conditions will

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be emphasized. Applications of these tools to various parts of economic theory will be presented.
E.G. Davis.

• Economics 43.594F1, W1, S1
Qualifying Year Tutorial
A tutorial for Qualifying Year students whose program includes the full slate of Qualifying Year core courses (microeconomic theory, macroeconomic theory, empirical methods, and applied economics).

• Economics 43.595F1, W1, S1
Applied Economics

• Economics 43.597F1, W1, S1
Qualifying Year Directed Readings

Graduate Courses*

Enrollment in the graduate courses requires the permission of the Departmental supervisors of graduate studies.

• Economics 43.501F1
Advanced Micro-Theory
An examination of the theories of the behaviour of individual economic agents: consumers and producers and their relation to the theories of price and distribution. Students are introduced to the controversies in the study of individual economic behaviour.
A.L.K. Acheson.

• Economics 43.502F1
Advanced Macro-Theory
Various formulations of the consumption, investment and demand for money functions are discussed. Macroeconomic models will be presented, including analysis of price level determination and inflation.
E.G. Davis.

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Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

• Economics 43.503W1
Welfare Economics for Policy
A rigorous exposition of theoretical welfare economics. An introduction to such topics as the role of voting in decision making, the economics of democracy and bureaucracy; the relationship of such forces to the theory of economic policy.
Prerequisite: Economics 43.501.
E.G. West.

• Economics 43.504W1
Stabilization Policy
An examination of policies aimed at achieving internal and external stability. The implications of economic growth for stabilization policies will be discussed.
Prerequisite: Economics 43.502.
K.A.J. Hay.

• Economics 43.505W1
Econometrics
Estimation and testing of the general linear model with emphasis on problems such as autocorrelation, heteroscedasticity, multicollinearity and problems due to distributed lags and errors in variables. Introduction to simultaneous equations systems, identification and estimation.
Prerequisites: Economics 43.220, 43.592, or equivalent.
S.B. Park.

• Economics 43.507F1, W1, S1
Directed Readings
Prerequisite: Permission of the chairman.

• Economics 43.508T2
Directed Readings
Prerequisite: Permission of the chairman.

• Economics 43.509F1, W1, S1
Directed Research
At least one paper will be required from a student enrolled in any one of these courses.
Prerequisite: Permission of the chairman.

• Economics 43.511W1
Canadian Economy I
A detailed examination of aspects and problems of the Canadian economy. A variety of topics may be discussed, including the economic development of Canada, the structure of the current national and regional economies, industrial organization, factor market operation, income

distribution, the role of international trade and capital flows, and the stability of the economy.
H.E. English.

• Economics 43.512S1
Canadian Economy II
Economic theory applied to the workings of the Canadian economy. Empirical estimation of various aspects of factor market operation, production, distribution and aggregate economy. Participants are expected to prepare and present papers for discussion.

• Economics 43.515T2
History of Economic Thought
The crucial achievements in economic theory and doctrine in the nineteenth and twentieth centuries are studied. Special emphasis is given to the interrelationship between the social environment and economic thought—especially to the role of economics in the development of the national state and international institutions.
E.G. West.

• Economics 43.530T2
Industrial Policy
An examination of the theories pertaining to industrial organization and their application to particular industries in Canada and elsewhere by way of empirical studies. Attention is given to the service sector as well as the manufacturing and resource sectors, and to international aspects of industrial organization. A range of public policies used to promote and restrict competition in terms of both conduct and performance are discussed; for example, control of restrictive practices, public ownership, commercial policy and various aspects of industry regulation.
C.J. Maule and D.G. McFetridge.

• Economics 43.540T2
Public Finance
A discussion of the government's role in the economy with emphasis on the Canadian public sector. Topics include the theory of public expenditures and taxation, models of collective choice, redistribution, intergovernmental relations, benefit-cost analysis and stabilization policy.
W.P. Hettich.

• Economics 43.545W1
Theoretical Welfare Economics
A rigorous treatment of the theoretical foundations of welfare economics. An introduction to axiomatic social choice theory with emphasis on the determination of collective choice rules from individual choice rules, the various types of measurability and comparability assumptions and impossibility results of the Arrow-type.
Stanley Wong.

• Economics 43.546W1
Economic Growth
An examination of modern theories of economic growth. Constraints of renewable and non-renewable resources. Trade-offs between economic growth and environmental decay. Problems of inter- and intra-generational income distribution.

• Economics 43.551F1
Economic Dynamics: Business Cycles
An analysis of the nature and causes of fluctuations in income, prices and employment. Short-run dynamic models arising from multiplier-accelerator and other economic processes will be examined. Cycle simulation; forecasting, stability conditions; anti-cyclical policy and the problems of maximizing growth without cycles will be discussed.
K.A.J. Hay.

• Economics 43.555F1
The Economics of Development
An examination of some key problems of development in the "Third World", including theoretical analysis and policy formulation and evaluation. Topics considered may include some of the following: dualistic models of development; choice of production technique; income distribution; choice of organizational form; intersectoral resource allocation, etc.
Prerequisites: Economics 43.590 and 43.591 or equivalents.
S.W. Langdon.

• Economics 43.560T2
International Economic Theory and Policy
International trade theory and its implications for economic policy are examined during the first term, which considers topics such as determinants of trade and specialization, gains

from trade and commercial policy, international factor mobility, and trade, growth and development. International monetary theory and its implications for economic policy are examined during the second term, which considers topics such as sources of equilibrium and disequilibrium in the balance of payments, balance-of-payments adjustment under fixed *versus* flexible exchange rates, international capital movements, and recent issues in the international monetary system.
Richard Brecher.

• Economics 43.566T2
Monetary Theory and Policy
This course is designed to provide the analytical tools of monetary theory and policy. The effects of monetary change on economic activity, the foundations of monetary theory, and classical, Keynesian and modern monetary analyses are discussed. The policy implications of the "optimum quantity of money", various estimates of money supply and demand, difficulties of implementing policy in open and closed economies and in a growth context, are also examined.

• Economics 43.570T2
Comparative Economic Systems
An analysis of the structure and functioning of economic systems. Some discussion of the notion of an economic system and of the criteria used to evaluate the performance of systems.
R.L. Carson.

• Economics 43.575T2
Mathematical Economics
A synthesis of some important topics in economic theory, with almost exclusive use of mathematical models. Some of these are: general equilibrium of the firm and/or the household, and related matters; general equilibrium of exchange and production; stability of equilibrium; linear programming, games, and the theory of the firm; selected topics in economic dynamics; value theory; social welfare functions; optimizing techniques and public policy.
Prerequisite: Mathematics 69.201, Economics 43.200, 43.210 or equivalent.
May be taken by senior undergraduates, with permission of the chairman and the instructor.

• Economics 43.580W1
Urban Analysis
An examination of the economic properties of urban areas. Attention will be focused on the macro-dynamics of urban development, together with the micro-statics of the equilibrium properties of the urban land market. The impact of public policy in Canada on urban areas will be assessed in the light of the formal analysis.
Allan Maslove.

• Economics 43.581F1
Regional Analysis
Regional economic disparities in Canada, theories and public policy relating thereto. Consideration will be given to the concept of regions, location of industry and industrial structure and to growth determinants. Various aspects of policy designed to improve the fortunes of the less-prosperous regions will be examined.
T.N. Brewis.

• Economics 43.585W1
Advanced Econometrics
Selected topics from estimating and testing the regression and simultaneous equation models are analyzed. The main topics include maximum likelihood estimation, statistical analysis of residuals, autoregressive and other time series models, multivariate regression model, and elements of asymptotic statistical theory within the context of the simultaneous equation model.
Prerequisites: Economics 43.485, 43.505 or equivalent.

• Economics 43.598T2
M.A. Tutorial
E.U. Choudhri and J.C. McManus.

• Economics 43.599F3, W3, S3
M.A. Thesis

• Economics 43.600F1
Economic Theory I: Microeconomics
This course includes lectures and seminars on selected aspects of topics such as consumer behaviour, producer behaviour, market structures, income distribution, and general equilibrium. Attention will be given not only to

descriptive theory but also to implications for economic policy.
Prerequisites: Economics 43.501 and 43.503, or equivalents.
Richard Brecher.

• Economics 43.601F1
Economic Theory II: Macroeconomics
Lectures and seminars on critical aspects of consumption, investment, government expenditure, taxation, external economic equilibrium, money, prices and employment stabilization and economic growth. Emphasis will be placed on policy implications.
Prerequisites: Economics 43.502 and 43.504 or equivalents.
J.F. Chant.

• Economics 43.602W1
Analysis of Microeconomic Policy
An examination and evaluation of microeconomic policies. Various aspects of policy issues are analyzed. These will be drawn from such areas as industrial economic policy, renewable and non-renewable resources, communication and transportation, regional economic policy, social economic policy, and operations of the labour market.
W.P. Hettich.

• Economics 43.603W1
Analysis of Macroeconomic Policy
An examination and evaluation of macroeconomic policies. Policy issues are discussed, alternative solutions formulated and their outcomes considered. Attention will focus upon such areas as incomes policy, taxation and budgetary policy, central bank operations, exchange rate manipulation, and commercial policy.
K.A.J. Hay.

• Economics 43.606F1
Economic Models and Policy Applications
Selected topics in the literature of econometric model building, and consideration of their relevance to the design of economic policy. Topics include aggregation bias, causality and recursivity, analysis of dynamic properties of reduced forms, among others. Also included is a survey and comparative analysis of existing Canadian macroeconometric models. A detailed examination of one Canadian model will be made, and students will have the opportunity to conduct policy simulations with it.
Prerequisite: Economics 43.505 or equivalent.
Ronald Bodkin and Stanley Winer.

• Economics 43.608F1
Topics in Advanced Micro-Theory

• Economics 43.609W1
Topics in Advanced Macro-Theory

• Economics 43.611F1, W1, S1
Workshop in Economic Policy
Forums in which graduate students and faculty can work together on policy questions. Workshops will be held in the following fields: urban and regional economics; economic organization and development; money and trade; public economics; and quantitative methods.

Doctoral students are required to join two workshops and present a paper to one of these groups.

The courses listed below (up to and including 43.697) indicate the areas in which members of the Department are prepared to supervise directed reading, research and seminars. Not all the courses will necessarily be offered in any one year. Permission of the chairman is required.

• Economics 43.630F1
Industrial Organization I

• Economics 43.631W1
Industrial Organization II

• Economics 43.640F1
Public Finance I: Advanced Taxation Theory

• Economics 43.641W1
Public Finance II: Advanced Expenditure Theory

• Economics 43.660F1
Theory of International Trade

• Economics 43.661W1
Monetary Theory

• Economics 43.662W1
Balance of Payments and International Monetary Theory

- Economics 43.680F1
Urban and Regional Economics I

- Economics 43.681W1
Urban and Regional Economics II

- Economics 43.696F1, W1, S1
Selected Advanced Topics

- Economics 43.697T2
Selected Advanced Topics

- Economics 43.699F10, W10, S10
Ph.D. Thesis

The Department

Chairman of the Department: D.B. Knight
Departmental Supervisor of Graduate Studies: J.K. Torrance

The Department of Geography offers programs of study and research in physical and human geography leading to the degree of Master of Arts. Inquiries are welcomed about interdisciplinary topics and post-M.A. study that may be undertaken in cooperation with other departments of the University.

The program of study for each student is based on the interests of the individual. An Advisory Committee, consisting of the student's research supervisor and at least two other members of the Department, is set up to monitor and provide guidance for the student's research. The Department has excellent laboratory facilities for the geotechnical study of near surface processes and the physics, chemistry and thermodynamics of earth materials. There is a large map library and a well-equipped cartography laboratory as well as a mini-computer/plotter/digitizer. These facilities are supported by a highly qualified full-time staff in laboratory instrumentation, cartography and data processing. The location of the University in the nation's capital offers the student access to important resources such as the National Library, National Archives, and Statistics Canada.

Currently, the main areas of specialization in the Department are the following:

Physical Geography and Geotechnical Science
Studies of natural processes close to earth's surface especially as they apply to environmental management: climate-ground interaction; micro-meteorology in frozen ground regions; the chemical, physical and thermodynamic properties of soils and sediments; hydrology and sedimentology of fluvial processes in glacial and periglacial environments. Current emphasis in investigations of geotechnical concern are cold region phenomena, soil-water relations and stability of marine clays. (J.P. Johnson, M.W. Smith, J.K. Torrance, T.P. Wilkinson, P.J. Williams)

Cultural and Historical Geography
The effect of cultural attitudes and techniques on the evolution of human groups, their organization of earth's space and resources in past and present landscapes, cross-cultural studies focusing particularly on the role of political and religious authority and ideology in changing the physical environment, concepts of territory and territoriality; and perception of the environment and settlement history. (John Clarke, D.B. Knight, G.C. Merrill, D.R.F. Taylor, P.E. Uren)

Urban and Economic Geography
Identification of basic spatial regularities in the socio-economic organization of human activity. Spatial decision making and spatial dynamics as exemplified in the internal structure of urban places, industrial location, regional organization and characteristics of transport systems. (David Bennett, D.M. Ray, J.E. Tunbridge, A.I. Wallace)

Rural and Resource Development
Identification of development processes; the interplay of population, political, demographic, socioeconomic variables with land resources and spatial factors. Frontier settlement, rural-urban evolution in developing countries, and recreational land use of particular interest. (D.M. Anderson, D.R.F. Taylor, P.E. Uren)

Cartography
Research and course work in cartography is possible within the Department, but the opportunity for wider experience may be obtained through arrangements by which a student may take for credit at Carleton one or more courses in cartography offered by the Department of Geography, Queen's University. The principal areas of focus are map design and history of cartography at Queen's, and applied aspects of computer cartography at Carleton.

Students may register in either department, and will follow the normal regulations and requirements of their university of registration. When appropriate for students in the cooperative program, representatives from both universities may be members of a student's thesis examining board.

Financial aid for transport between cities will be provided by the home department.

Systematic interests of Departmental members are applied to regions of special interest: Africa (Knight, Taylor); South West Pacific (Knight); Arctic and Subarctic (Smith, Johnson, Williams); Eastern Europe and U.S.S.R. (Uren), Canada (Anderson, Clarke, Wallace, Knight)

Qualifying Year Program

Applicants with exceptional promise who have a general (pass) Bachelor's degree, or who have substantially less than the Honours B.A. in geography may be admitted to a Qualifying Year program. To be considered for admission into the Master's program, Qualifying Year students must attain at least an overall high second-class standing in their Qualifying Year geography courses. The general section of this Calendar provides details about the regulations governing the Qualifying Year.

Master of Arts

Admission Requirements

The normal requirement for admission into the Master's program is an Honours B.A. or B.Sc. in geography with at least a high second-class standing. Applicants who have taken their undergraduate degree in the physical or natural sciences or engineering as well as in physical geography will be considered if their research interest coincides with those of the Department. Applicants in human geography may be accepted from related fields if their proposed research is closely related to faculty research experience. Students with academic deficiencies may be required to take additional courses.

Program Requirements

The M.A. in geography is expected to take 12 months, but field work may necessitate some extension. All Master's students in geography are required to complete a minimum of five full courses or the equivalent, including an M.A. thesis (equivalent to two full courses) which must be defended at an oral examination. A reading knowledge of the language which is essential to his or her research is required of all students.

Graduate Courses*

In addition to the selection of courses offered by the Department, graduate students in geography are encouraged to consider, in partial fulfillment of their degree requirements, appropriate courses offered in such disciplines as biology, chemistry, economics, engineering, geology, history, international affairs, physics, political science and sociology.

Courses at the University of Ottawa may also be taken for credit in a Carleton M.A. program. Permission of departments in both universities is required.

The prerequisite for all courses in the Department is permission of the supervisor of graduate studies and the instructor.
The following courses, normally offered annually, are scheduled for 1978-79:

• Geography 45.500F1
Graduate Research Seminar
The application of scientific principles of investigation to contemporary research in geography. This course is suitable for students regardless of specialization.
David Bennett.

• Geography 45.510F1
Models of Geographic Processes
Examination of recent developments in the collection, analysis and portrayal of geographic information.
John Clarke.

• Geography 45.517F1, W1, S1
Field Study and Methodological Research
Field acquisition and analysis of geographic

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

material. Supervised field observations and methodology. Individual or group basis, by special arrangement.
Coordinator: J.K. Torrance.

• Geography 45.520F1
Rural-Urban Interaction in Africa
The problems facing developing nations today with emphasis on their spatial aspects. Examples will be drawn from African nations.
(Also offered as International Affairs 46.575)
D.R.F. Taylor.

• Geography 45.532F1
Experimental Geomorphology
Instrumental techniques for investigation of hydrological and thermal processes near the earth's surface; laboratory instrumentation; analysis of laboratory and field procedures in geotechnical science.
P.J. Williams.

• Geography 45.533W1
Periglacial Geomorphology
Permafrost, its distribution and significance; seasonal ground freezing; ground thermal regime; physical, thermodynamic and geotechnical properties of freezing and thawing soils; terrain features ascribable to frost action; solifluction and patterned ground.
P.J. Williams.

• Geography 45.534W1
Aspects of Clay Mineralogy and Soil Chemistry
The role of clay minerals in soils will be considered from a geotechnical and/or biological perspective.
J.K. Torrance.

• Geography 45.536W1
Floating Ice Studies
Growth and classification of river, lake, and sea ice. Materials properties and engineering applications of floating ice. Remote sensing of ice in the active and passive microwave region, and other selected topics from the current literature.
R.O. Ramseier.

• Geography 45.540F1
Explorations in Cultural and Historical Geography
Review of major themes and methods of cultural-historical and political geography leading to integrated examination of three related themes: territorial organization and sense of place, authority and ideology and landscape change, and political interference in a cultural world. Cross-cultural, but emphasis on Africa and Canada.
D.B. Knight.

• Geography 45.550F1
Spatial Dynamics of Urban and Regional Systems I
Research paradigms and geographic models. The spatial consequences of individual and corporate decision making, and public policy constraints in advanced industrial economies.
A.I. Wallace.

• Geography 45.551W1
Spatial Dynamics of Urban and Regional Systems II
Research paradigms and geographic models. The spatial consequences of individual and corporate decision making, and public policy constraints in advanced industrial economies.
D.M. Ray.

• Geography 45.555F1
Tourism and International Development
The nature and effect of tourist development in various parts of the world and the role of tourism in developed and developing countries.
G.D. Taylor.

• Geography 45.570W1
Problems of Development in Arctic and Subarctic Environments
Research seminar on specific problems in Canada's northland. Experience from other parts of the world will be incorporated when appropriate.
J.P. Johnson.

• Geography 45.572W1
Issues in Canadian Resource Development
An overview of Canadian natural resource problems and prospects, concentrating on agriculture, forestry, energy, minerals and off-shore resources.
A.I. Wallace.

• Geography 45.579W1
Research and Development in Recreational Geography

Contemporary trends and research in recreational demand, travel, user activities; evaluation of landscape for recreation, preservation of recreational "quality", parks and recreation systems planning.
D.M. Anderson.

• Geography 45.580W1
Spatial Information Systems and Computer Cartography
The concepts and problems involved with spatial information systems, especially those with a mapping component.
D.R.F. Taylor.

• Geography 45.582F1
Seminar in Historical Cartography
A seminar on selected problems in historical cartography.
(Offered at Queen's University as 38-877)

• Geography 45.590F1, W1, S1
Graduate Tutorial
Tutorial, directed reading or research; offered on an individual basis, to meet specific program needs; may be taken in one of the areas of specialization of the Department.
Coordinator: J.K. Torrance.

• Geography 45.599F4, W4, S4
M.A. Thesis
Thesis supervision will be given in all areas of specialization of the Department, as listed in the Calendar section identifying Departmental specializations.
Coordinator: J.K. Torrance.

Courses Not Offered in 1978-79

45.535 Glaciology
45.543 Selected Concepts in Cultural Geography
45.545 Problems in Historical Geography
45.571 Selected Studies in the Human Geography of Arctic and Subarctic Lands
45.581 Seminar in Map Design

The Norman Paterson School of International Affairs

The School

Director of the School: J.H. Sigler

The Norman Paterson School of International Affairs, established in 1965 with the generous support of the Honourable Norman M. Paterson, offers a program of studies leading to the M.A. degree.

The program focuses on four themes: international integration, development studies, Canada's international policies, and conflict analysis. Attention is paid to the role of international institutions, the foreign policies of other countries, and to selected regional studies. The School maintains close cooperation with the Institute of Soviet and East European Studies, and with committees designed to encourage and coordinate faculty and student interests in Africa, Asia and Latin America. The chairmen of these committees are: on Africa, D.R.F. Taylor (Department of Geography); on Asia, Venkateswarier Subramaniam (Department of Political Science); and on Latin America, A.R.M. Ritter (Department of Economics).

A specialized Resource Centre is located in the School and is staffed by a full-time information specialist. Students and faculty have access to a broad range of current bibliographic materials using the resources of the national capital area as well as on-line computerized bibliographic services in foreign policy and international affairs. The School also participates in the Social Science Data Archives at Carleton, and students have access to a full range of data sets available from the Inter-University Consortium for Political Research as well as the Canadian Institute of Public Opinion poll data and the Human Relations Area Files.

Qualifying Year Program

Admission Requirements

The Qualifying Year program is designed to enable students with at least second-class standing but with inadequate background in the disciplines relevant to the M.A. program to make up deficiencies. Candidates with a general (pass) Bachelor's degree in a discipline closely related to international affairs, and those with an Honours bachelor's degree in an unrelated discipline, may be required to take three to five Qualifying Year courses before being eligible to enter the Master's program.

Students in the Qualifying Year are encouraged to select a core theme. They may also wish to select an area emphasis and to take courses that will enable them, in the M.A. year, to engage in specialized study in the problems of a region having particular relevance to the core theme they have elected. Students should also take appropriate courses in order to prepare them to fulfill the language requirements of the M.A. program.

Under current practice, students are expected to achieve a high second-class standing (or B plus) in Qualifying Year courses in order to be admitted to the M.A. year.

Program Requirements

International Integration

Two courses are recommended: Economics 43.360 or 43.361 (half-courses), and Political Science 47.360 and 47.361 (half-courses), or 47.460 and at least two courses relating to a region where the nature and effects of integration may be studied; for example, courses bearing on the European Economic Community, Comecon, or an integration process in less-developed areas.

Development Studies

The following courses will normally be required: Economics 43.360 or 43.361 and 43.363 (half-courses), and at least one course in geography, political science or sociology and anthropology relevant to this theme. Particularly recommended are courses on one of the developing regions: Geography 45.330 or 45.380 and 45.381 (half-courses), Political Science 47.310, 47.315, or 47.411, Anthropology 54.230 and 54.362, and Sociology 53.360.

Canada's International Policies

The following courses are recommended: History 24.334 and 24.336; Economics 43.325 and 43.360, 43.361 and 43.380 (half-courses); and Political Science

47.361, 47.365 and 47.366 (half-courses).

Conflict Analysis
The following courses are recommended: History 24.380, 24.480 or 24.481; Law 51.463; Political Science 47.361 and 47.365 (half-courses) and 47.270 and 47.460; and Sociology 53.306 and 53.358. Also recommended are courses dealing with other approaches to conflict or with regions in which the student may wish to apply conflict theory.

Master of Arts

Admission Requirements

The minimum requirement for admission into the Master's program is an Honours bachelor's degree in a discipline related to international affairs.

Under current practice, at least a high second-class (or B plus) standing is normally required for consideration for admission to the program.

Students may wish to provide scores on the Graduate Record Examination Aptitude Test in order to assist the Admissions Committee.

The Faculty of Graduate Studies and Research requires applicants whose native tongue is not English to be tested for proficiency in English, as described in the Application for Admission section, page 11, of the General Regulations in this Calendar.

Candidates who lack the required background in international affairs will be expected to take a maximum of two additional courses. Core seminar requirements are listed under Program Requirements for Qualifying Year.

Program Requirements

The normal program requirements for M.A. students in international affairs who elect to write a thesis or research essay are:

- one interdisciplinary core seminar selected from the following:

International Affairs
46.500 International Integration
46.505 Development Studies
46.510 Canada's International Policies
46.515 Conflict Analysis

Each of these core seminars is valued at one credit (one full course).

- two other approved courses (or the equivalent) in international affairs or related disciplines if a student elects to write a thesis;
- three other approved courses (or the equivalent) in international affairs or related disciplines if a student elects to write a research essay;
- a thesis (valued at two credits) or a research essay (valued at one credit) involving original research on an approved subject in the field of international affairs;
- an ability to read a second major international language or a language vital to a student's major research interest;
- an oral comprehensive examination, primarily on the thesis or research essay and core seminar, to determine the candidate's ability to relate various disciplines to the study of international affairs.

Canadian students are encouraged to develop proficiency in French.

For students who elect a five-course program without writing a thesis or research essay:

- one interdisciplinary core seminar selected as above;
- four other approved courses selected as above;
- language requirements as above;
- a written and oral comprehensive examination on three fields to determine the candidate's ability to integrate the course work and relate various disciplines to the study of international affairs.

Academic Standing

A grade of B- or better must be obtained in each course counted for credit towards the Master's degree.

Graduate Courses*

• International Affairs 46.500T2
International Integration
The study of political, economic, and social integration of nations, with particular emphasis on Western Europe.

• International Affairs 46.505T2
Development Studies
The study of the principles and problems of development in the less industrially advanced regions of the world.

• International Affairs 46.510T2
Canada's International Policies
An examination of the development of Canada's policies in international affairs since 1945, using case studies to analyze the interests and objectives involved in the formulation of those policies.

• International Affairs 46.515T2
Conflict Analysis
A study of contemporary theories of international conflict, war and peace.

• International Affairs 46.520F1
Studies in Strategy and Security
Selected topics in strategic theory and practice.

• International Affairs 46.521W1
Studies in Strategy and Security
Selected topics in strategic theory and practice.
(Also offered as Political Science 47.586)

• International Affairs 46.525W1
International Monetary Institutions

• International Affairs 46.526F1
Integration in Developing Countries

• International Affairs 46.530T2
The International Enterprise
Economic and political developments in the fields of international trade and investment as they relate to the operations of international enterprises. The impact of international enterprises on host countries and the policy response of host governments, with special attention devoted to the Canadian situation.

• International Affairs 46.531F1
Science, Technology and International Affairs - Analytical Approaches
(To be taken by all students who intend to complete either I.A. 46.532 or I.A. 46.533 in the winter term)

• International Affairs 46.532W1
Science, Technology and International Affairs - the Developed Countries

• International Affairs 46.533W1
Science, Technology and International Affairs - the Less-Developed Countries

• International Affairs 46.535F1
The Political Economy of East-West Relations

• International Affairs 46.536F1
Problems in Middle East Affairs

• International Affairs 46.545W1
Foreign Policies and Conflict in Africa

• International Affairs 46.546W1
Development Problems in Latin America

• International Affairs 46.555F1
Development Problems in South and Southeast Asia

• International Affairs 46.556W1
Advanced International Legal Problems
(Also offered as Law 51.567)

• International Affairs 46.565W1
The International Economics and Politics of Resources

• International Affairs 46.566W1
Integration in Eastern Europe

• International Affairs 46.575F1
Rural-Urban Interaction in Africa
(Also offered as Geography 45.520)

• International Affairs 46.591F1, W1, S1
Tutorials in International Affairs
To be chosen in consultation with the director.

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

- International Affairs 46.598F2, W2, S2
Research Essay

- International Affairs 46.599F4, W4, S4
M.A. Thesis

Selection of Courses

In addition to the graduate courses offered in the School, qualified students may choose from among courses in international affairs offered by related departments, schools and institutes. The following courses are particularly recommended:

Economics
43.511 Canadian Economy I
43.512 Canadian Economy II
43.530 Industrial Policy
43.555 The Economics of Development
43.560 International Trade and Policy
43.570 Comparative Economic Systems
43.581 Regional Analysis

Geography
45.540 Explorations in Cultural and Historical Geography
45.543 Selected Concepts in Cultural Geography
45.555 Tourism and International Development

History
24.535 Canada in the North Atlantic World, 1900-1939
24.536 Canada Between the Wars, 1919-1939
24.570 A Seminar in British Imperial History

Law
51.550 The Canadian Constitution
51.553 Advanced Legal Problems of Federalism
51.563 International Law

Political Science
47.506 Problems of Canadian Government and Politics I
47.507 Problems of Canadian Government and Politics II
47.514 Comparative Communist Politics, Theory and Practice
47.515 Comparative Communist Politics, Selected Aspects
47.516 Selected Problems in Soviet Politics
47.517 Selected Problems in African Politics
47.520 Nationalism
47.521 Multiculturalism
47.545 Public Administration in Developing Countries
47.550 Problems in Western European Politics
47.560 Theory and Research in International Politics
47.561 Canadian Foreign Policy
47.570 Advanced Research Methods
47.581 Foreign Policies of African States
47.585 Foreign Policy Analysis
47.587 Analysis of International Organization
47.589 Problems in International Politics

Public Administration
50.500 Public Sector Managing and the Canadian Political System
50.530 Organizational Behaviour I
50.531 Organizational Behaviour II
50.565 Government-Industry-Policy Relations
50.566 Science and Technology Policies
50.568 Policy and Decision Making
50.572 Policy Seminar on Nuclear Policy

Religion
34.510 Seminar in Comparative Religion
34.511 Seminar in Comparative Religion

Sociology and Anthropology
53.507 Theories of Social Change and Modernization
53.512 Statistical Methods I
53.513 Statistical Methods II
54.517 Sub-Saharan African Ethnography
53.520 Comparative Social Systems
53.525 Canadian Society

54.539 Political Anthropology
53.540 Political Sociology
53.550 National Unity in Multi-Ethnic Societies
53.575 Sociology of Migration

Soviet and East European Studies
55.500 Interdisciplinary Seminar on the Soviet Union and Eastern Europe

Department of Law

The Department

Chairman of the Department: D.W. Elliott
Director of the Jurisprudence Centre: P.J. Fitzgerald

Although the Department of Law does not offer a program of studies leading to the M.A. degree, it actively participates in such interdisciplinary graduate programs as those offered by the Norman Paterson School of International Affairs, the Institute of Canadian Studies and the School of Public Administration. Members of the Department also supervise graduate theses and research essays and provide graduate level tutorials dealing with the legal aspects of other disciplines.

The Jurisprudence Centre, established by the Department in 1974, is a forum for the advanced interdisciplinary study of problems related to law, law reform, and politics.

Currently, the Department of Law offers five courses at the graduate level.

A number of courses offered by the Department at the 400 level are part of interdisciplinary graduate programs in such areas as public administration, international affairs, and Canadian studies. These courses are described in the *Undergraduate Calendar.*

Graduate Courses*

• Law 51.550F1
The Canadian Constitution
A highly concentrated half-course designed to familiarize graduate students with the terminology, principles and doctrines of judicial interpretation of the B.N.A. Act and other constitutional statutes. The emphasis will be on the division of legislative powers in the Canadian federation. This course or its equivalent is a prerequisite for the course on Advanced Legal Problems of Federalism (51.553).
Prerequisite: Open only to graduate students in their Master's year who have not previously studied Canadian constitutional law. Graduate students at the Qualifying Year level are advised to consider registering in Canadian Constitutional Law (Law 51.450).

• Law 51.553W1
Advanced Legal Problems of Federalism
An advanced study of selected Canadian constitutional problems including constitutional revision. Some comparisons with other federal systems may be made.
Prerequisite: A course in Canadian constitutional law.

• Law 51.563W1
International Law
A highly concentrated half-course designed to familiarize graduate students with the terminology, principles and doctrines of the law of nations. This course or its equivalent is a prerequisite for all international law courses at the 500 level.
Prerequisite: Open only to graduate students in their Master's year who have not previously studied international law. Graduate students at the Qualifying Year level are advised to consider registering in Public International Law (Law 51.463).
J.G. Neuspiel.

• Law 51.567W1
Advanced International Legal Problems
In 1978-79 this seminar may involve an in-depth study of the law of treaties or the international law of peacekeeping.
(Also offered as International Affairs 46.556)
Prerequisite: Law 51.463 or equivalent, or permission of the Department.
J.G. Neuspiel and others.

Courses Not Offered in 1978-79

51.555 Administrative Law II

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

The Department

Chairman of the Department: R.J. Jackson
Departmental Supervisor of Graduate Studies: I.G. Stevenson

The Department offers programs leading to the M.A. and Ph.D. degrees. Specialized graduate study and research may be undertaken in the fields of political theory, Canadian government and politics, comparative government and politics, international relations, and public administration. Within these fields, students may select more specialized areas of concentration, such as classical, medieval and modern, or analytic and empirical theory, comparative government and politics of a particular area or group of countries, such as Africa, Eastern Europe, or South and East Asia where the Department has developed particular strength and resource materials.

Ottawa provides a wealth of resources, both in personnel and in research material, for the student of government, politics, public administration, and international relations. Carleton has specialized schools and institutes in interdisciplinary study in public administration, Canadian studies, international affairs, and Soviet and East European studies. In addition to the University facilities, Ottawa offers the graduate student in political science a host of study and research opportunities unparalleled in Canada. The Public Archives, the National Library, the Library of Parliament, the Supreme Court Library, the National Museums, and Statistics Canada are all located in Ottawa. The headquarters of all government departments, most federal government agencies, and a multitude of national organizations and trade associations are located in Ottawa; many maintain specialized libraries. Some of the embassies and diplomatic missions located in Ottawa maintain specialized libraries and offer access to documents and other research materials.

Qualifying Year Program

Applicants who have a general (pass) B.A. in political science, with high standing (grade point average of at least 7.0) may be considered for admission to a Qualifying Year program. Candidates who complete the Qualifying Year with at least B standing (grade point average of 8.0, with no grade less than B–) may proceed to the Master's program the following year. A candidate may, with the approval of the Departmental Graduate Studies Committee, be allowed a grade of C+ or C in one full course or each of two half-courses in meeting the required 8.0 average.

Refer to the general section of this Calendar for details of the regulations governing the Qualifying Year.

Master of Arts

Admission Requirements

The normal requirement for admission to the Master's program is an Honours B.A. (or the equivalent) in political science, with at least B standing. This normally will mean a Carleton grade point average of 8.0, taking into account both transcript and letters of reference.

Honours graduates in fields other than political science will be considered on the basis of their academic background and standing. Those with deficiencies may be required to take additional courses or to register in the Qualifying Year program.

Program Requirements

All Master's candidates will enroll in an approved number of courses in political science, including political theory and research methodology if not already taken. No more than one of these courses may be taken at the 400 level.

Each candidate, in consultation with the Department, will select and follow one of the following three optional program patterns:

- five full courses (or the equivalent) in political science;
- four full courses (or the equivalent) in political science, and a research essay on a topic related to one of the courses;
- three full courses (or the equivalent) in political science and a research thesis, equivalent to two full courses, in an approved field.

All Master's candidates in political science must also undertake a comprehensive oral examination on approved major and allied fields. Details of this examination are outlined below under Comprehensive Examination.

All candidates must normally demonstrate a reading knowledge of French. Students from abroad, whose mother tongue is other than English or students whose research interests require another language, may obtain permission from the Departmental Graduate Studies Committee to substitute this language for French. Language tests are conducted twice a year, in October and February.

A supervisor will be assigned to each candidate to advise and assist in the preparation for the comprehensive and language examinations.

Comprehensive Examinations

All Master's candidates in political science must successfully pass an oral comprehensive examination in a major field of concentration chosen from the following list:

- Political Theory
- Canadian Government and Politics
- Comparative Government and Politics
- International Relations
- Public Administration

The comprehensive examination will cover not only depth of knowledge of the literature in the field, but the relation of theory and research in that field of political science to an allied field in political science or, with the approval of the Departmental Graduate Studies Committee, a discipline related to political science. To prepare for the comprehensive examination, the student will pursue an approved program of courses related to his chosen field.

Academic Standing

All Master's candidates must obtain at least B standing (grade point average of 8.0). One grade of C+ may be allowed.

Doctor of Philosophy

The Ph.D. program in political science may be undertaken only on a full-time basis.

Admission Requirements

The normal requirement for admission to the Ph.D. program is a Master's degree (or its equivalent) in political science, public administration, or international affairs, with at least high second-class standing. This normally will mean a Carleton equivalent grade point average of 9.5 taking into account both transcript and letters of reference.

Program Requirements

The normal program requirements for Ph.D. candidates are outlined in the general section of this Calendar.

All students are required to have or acquire an adequate basic knowledge of political theory and research methodology, regardless of their field of specialization. They will also be expected to undertake further work in statistics if statistical proficiency is needed for the preparation of the thesis.

The specific program requirements for Ph.D. candidates in political science are the following:

- At least three graduate full courses (or the equivalent); a grade point average of at least 9.0 must be obtained in these courses before proceeding to the comprehensive examinations. Additional courses may be required for candidates whose background or standing is deficient.
- Political Science 47.690 and 47.695 (Ph.D. Tutorials);
- proficiency in languages and/or research skills, as outlined below under Language and Research Skill Requirement;
- comprehensive examinations as outlined below under Comprehensive Examinations;
- A thesis, written in English or French, which must be defended in English at an oral examination; this examination may include material related to the general field of the thesis.

The completion of the Ph.D. program will normally require at least two years of full-time study beyond the Master's degree.

A supervisor and at least two other advisers will be assigned to each Ph.D. candidate to advise him/her on his/her studies. The student's entire program must be approved by the Department.

Language and Research Skill Requirement

All Ph.D. candidates must demonstrate an ability to use two research skills appropriate to their program, one of which must be a language other than English.

Candidates, one of whose fields is Canadian government and politics, or whose thesis deals mainly with Canada, must demonstrate an ability to read and translate French easily as one of their skill requirements.

All other candidates must demonstrate an ability to read and translate easily a language appropriate to their program.

The second skill requirement may be fulfilled in one of the following ways:

- a demonstrated ability to read and translate easily a second language;
- an oral knowledge of a language sufficient to conduct interviews in the language;
- satisfactory completion (B- or better) of Political Science 45.570, Advanced Research Methods;
- credit work in an approved political science methodology workshop or colloquium.

The research skill requirement must be satisfied before the thesis proposal defence.

Comprehensive Examinations

All Ph.D. candidates must undertake the following examinations:

- A written examination in two approved fields, covering general knowledge of the field and two approved areas of specialization in each field; an oral examination on the written material may be given at the discretion of the examining committee.
- a final oral comprehensive examination integrating the two fields.

The comprehensive examinations will normally be completed by the beginning of the seventh term of registration. Candidates will be expected to complete these examinations successfully before beginning the thesis. The fields of study for the Ph.D. examinations are to be chosen from the following list:

Political Theory
A general knowledge of the main outlines and significant themes and problems of political philosophy and thought with emphasis on two of the following: classical (mainly Greek and Roman); modern (Machiavelli through the nineteenth century); contemporary (twentieth century); Canadian and American political thought and its immediate European background; current theories and approaches to political analysis; methodology and theory construction.

Canadian Government and Politics
A general knowledge of Canadian political ideas, institutions, and processes, with emphasis on two of the following: federalism and the constitution; parliament and legislatures; parties, elections and interest groups; political culture and socialization; political economy; provincial government and politics; public policy and administration (if not chosen as a sub-field under Public Administration); Canadian political thought and ideology.

Comparative Government and Politics
A general knowledge of the theories and methodology of comparative politics with emphasis on one sub-field from each of the following two lists:

- Countries or areas: Western Europe; U.S.S.R. and/or Eastern Europe; United States; Africa; or an approved combination of countries or areas.
- Topics or themes: political development and integration; political stability and change; federalism; legislatures; local government and politics; multiculturalism and the politics of ethnicity; political parties and interest groups; public opinion and voting behaviour; policy analysis.

International Relations
A general knowledge of international theory, international institutions and world history since 1914, with emphasis on two of the following: analytical international theory; foreign policies of particular states; international institutions and law; international integration; conflict resolution and peace research; strategic studies.

Public Administration
A general knowledge of theory, including comparative theory, and of practice in Canada, Britain and the United States, with emphasis

on two of the following topics: theories of administration and organization; Canadian public policy and administration (including some knowledge of provincial and municipal administration); comparative public administration (with reference to either developing or developed countries or an approved combination of countries); administrative responsibility (including judicial controls).

Selection of Courses

Within the scope of the regulations, the following undergraduate courses (fully described in the *Undergraduate Calendar*) may be taken by graduate students.

Political Science
47.400 Topics in Canadian Government and Politics
47.401 Policy Making in Canada
47.402 Policy Seminar: Problems of Northern Development
47.403 Politics and the Media
47.404 Interest Groups in Canadian Politics
47.405 Federalism
47.406 Legislative Process in Canada
47.409 French-Canadian Politics
47.410 Politics of Developed Societies
47.411 Politics of Developing Societies
47.420 Policy Making in the United States
47.421 Politics of Influence in the United States
47.422 American Constitutionalism
47.430 Modern Political Thought
47.431 Marxist Thought
47.432 Contemporary Marxism
47.435 The Conflict of Ideas in Contemporary Society
47.460 Analysis of International Relations
47.461 Soviet Foreign Policy
46.462 International Communist Movement
47.466 American Foreign Policy
47.470 Political Research Design and Data Analysis
47.482 International Politics of Africa

Except where an M.A. student is permitted to take an allied field in another discipline, a graduate student may take no more than one course in another department, school or institute, in fulfillment of the M.A. or Ph.D. requirements.

Graduate Courses*

• Political Science 47.500F1
Canadian Local Government and Politics
A research seminar on selected problems.

• Political Science 47.501W1
Canadian Provincial Government and Politics
A research seminar on selected problems.
Prerequisite: Political Science 47.200 or permission of the instructor.

• Political Science 47.502W1
Comparative Local Government
A seminar on the systems of local government in the United States, Britain and France (which have provided prototypes for many other countries), and systems in other countries, chosen according to the interests of the students.

• Political Science 47.505T2
Comparative Government
A research seminar dealing in the fall term with theories, methods and problems of comparison, and in the winter term with particular themes.

• Political Science 47.506F1
Problems of Canadian Government and Politics I
A research seminar on selected problems.

• Political Science 47.507W1
Problems of Canadian Government and Politics II
A research seminar on selected problems. In 1978-79 the course will be an application of anthropological methods and perspectives to an understanding of Canadian political symbolism, processes and institutions. Special attention will

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

be paid to such topics as political rituals, value systems, patron-client relations, community structure, electoral behaviour and party organization.
(Also offered as Anthropology 54.587)

• Political Science 47.508F1
The Politics of Energy and the Environment
A research seminar focusing upon the substantive issues, the policy structures and processes, and current Canadian governmental response in the area of energy policy and environmental quality management.

• Political Science 47.510T2
The Political Process in Canada
An analytical study of the democratic political process, with particular reference to political parties and elections, pressure groups and political leadership in Canada.

• Political Science 47.514F1
Comparative Communist Politics, Theory and Practice
Examination and analysis of basic models of communist political systems, with emphasis on problems of systemic change and adaptation (inclusive of Soviet, East European and Asian systems and Cuba).
Prerequisites: Political Science 47.320 and 47.215 or 47.312, or permission of the instructor.

• Political Science 47.515W1
Comparative Communist Politics, Selected Aspects
Examination and analysis of selected aspects of communist political processes, such as integration; elite formation, leadership and succession; decision making. The emphasis will change from year to year.
Prerequisite: Political Science 47.514 or permission of the instructor.

• Political Science 47.516W1
Selected Problems in Soviet Politics
A seminar on selected aspects of the Soviet political system with special attention to the interrelationship among politics, culture and society in the U.S.S.R.
Prerequisites: Political Science 47.100, 47.320 and 47.432 or permission of the instructor.

• Political Science 47.517F1
Selected Problems in African Politics
A political economy approach will be taken in this seminar, stressing the relationship of dependence, underdevelopment, participation and class formation to the decision-making process in selected countries.

• Political Science 47.520F1
Nationalism
A seminar on the historical and comparative study of nationalism, with emphasis on its role in the promotion of political change.

• Political Science 47.521W1
Multiculturalism
A research seminar on political aspects of multiculturalism. Primary emphasis will be on linguistic and cultural pluralism in developed societies, including Canada.

• Political Science 47.525F1
Problems in American Government I
A research seminar on topics such as the distribution of power, decision-making processes; the impact of technology; strains in intergovernmental relations; civil-military relations; governmental news management and secrecy; executive accountability; and impediments to reform of Congress and the presidency.

• Political Science 47.526W1
Problems in American Government II
A research seminar on topics such as political violence and social change; the roles of mass media; business elite roles; political corruption; civil rights and minority politics; and the urban crisis.

• Political Science 47.530T2
Political Theory
An intensive examination of the core questions and themes in the classical, medieval and modern phases of political philosophy, considered in their historical setting; and the major concepts and approaches used in contemporary political analysis.

• Political Science 47.532F1
Modern Political Culture and Ideology
A philosophical analysis of political culture, its principal forms and their importance for political society. In 1978-79 the theme is "Myth, Time and Politics".

• Political Science 47.533W1
Selected Topics in Political Theory
The content of this seminar may change from year to year. Work will center largely upon problems in the theory of democracy.

• Political Science 47.535T2
The Canadian and American Political Traditions
A seminar on the interpretation of the American, English-Canadian and French-Canadian political traditions, with emphasis on their comparative development.

• Political Science 47.540T2
Analysis of Canadian Public Policy and Administration
This course is intended to offer to the student the opportunity for an intensive examination of policy processes and institutions in Canada as well as more general theory and practice of public administration in this country.

• Political Science 47.544F1
Public Administration in Developed Western Countries
A seminar in comparative public administration with emphasis on Commonwealth countries, the U.S.A., France and West Germany.
Prerequisite: Political Science 47.446 or permission of the instructor.

• Political Science 47.545W1
Public Administration in Developing Countries
A seminar on the literature and characteristics of development administration; comparison by region, country, and topic, with emphasis on the English-speaking developing countries.
Prerequisite: Political Science 47.466 or permission of the instructor.

• Political Science 47.546T2
Theories of Public Administration
A seminar on theories of bureaucracy, organization, and comparison, with topics in the second half chosen according to the interests of the students.

• Political Science 47.547T2
Decision Theories and Policy Studies
This course will cover decision making and policy studies in a non-mathematical way from two complementary angles: basic philosophy, psychology and theory of individual and group decision making, and over-all policy analysis as pursued by Vickers, Dror, and others; with a brief look at tools of decision making.

• Political Science 47.550T2
Problems in Western European Politics
This course will deal intensively with politics in Britain, France, Germany, Italy, and selected minor European powers both democratic and authoritarian.
Prerequisites: At least one course beyond Political Science 47.100 on democratic or authoritarian governments, and either a comparative theory or a methodology course.

• Political Science 47.560T2
Theory and Research in International Politics
An examination of the principal problems in contemporary international relations theory and research, emphasizing the state of the field and current directions in it.
Prerequisite: Political Science 47.460 or permission of the instructor.

• Political Science 47.561F1
Canadian Foreign Policy
An analysis of policy formulation and external behaviour, largely through the study of cases, such as Suez and Vietnam, and issues, such as the new international economic order and relations with the United States. Particular attention is given to domestic sources of policy such as public opinion, and the behaviour of comparable actors, such as Australia and Sweden. Frequent visitors.
Prerequisite: Political Science 47.260 or permission of the instructor.

• Political Science 47.570T2
Advanced Research Methods
A seminar in research design, data collection, and data analysis. The course is intended to train students to conduct professional empirical research in political science. Depending on staff and student interests, topics may include the logic of design, survey research, aggregate data analysis, content analysis, forecasting, policy evaluation, roll-call analysis, formal analysis, and measurement and scaling.
Prerequisite: Political Science 47.470 or equivalent.

• Political Science 47.581W1
Foreign Policies of African States
The foreign policy determinants and international behaviour of African states. Each year, the seminar will focus on a particular issue area.

• Political Science 47.585W1
Foreign Policy Analysis
A research seminar dealing with selected problems in the study of foreign policy formulations and outcomes.
Prerequisite: Political Science 47.460 or permission of the instructor.

• Political Science 47.586W1
Strategy
A research seminar on the analysis of recent western as well as Soviet and Chinese strategic concepts; civilian-military relations; defence policy, decision making; and arms control and disarmament.

• Political Science 47.587F1
Analysis of International Organization
A research seminar on process and change in contemporary forms of international organization.
Prerequisite: Political Science 47.360 or permission of the instructor.

• Political Science 47.589F1
Problems in International Politics
A research seminar on the construction, testing and development of international political theory. Each year, the seminar will investigate intensively one substantive area, such as international conflict, interdependence, or integration.

• Political Science 47.590T2
Tutorial in a Selected Field
Tutorials or reading courses on selected topics may be arranged with the permission of the chairman and agreement of the instructor.

• Political Science 47.591F1, W1, S1
Tutorial in a Selected Field
Tutorials or reading courses on selected topics may be arranged with the permission of the chairman and agreement of the instructor.

• Political Science 47.594F1, W1, S1
M.A. Comprehensive Tutorial
Tutorial designed as preparation for the M.A. comprehensive examination, under the direction of members of the Department. The grade to be awarded will be that obtained on the comprehensive examination.

• Political Science 47.598F2, W2, S2
Research Essay
Tutorial for students who write a research essay rather than a thesis.

• Political Science 47.599F4, W4, S4
M.A. Thesis

• Political Science 47.690T2, 47.695T2
Ph.D. Tutorials
Ph.D. tutorials specifically designed as intensive preparation for the field examinations, under the direction of one or more members of the Department. The grade to be awarded will be that obtained on the field examination.

• Political Science 47.691T1, 47.692T1
Ph.D. Tutorials (half-courses)
Ph.D. tutorials specifically designed as intensive preparation for the minor field examinations, under the direction of one or more members of the Department. The grade to be awarded will be that obtained on the field examinations. (Registration limited to students who entered the Ph.D. program prior to 1976-77.)

• Political Science 47.699F10, W10, S10
Ph.D. Thesis

Department of Psychology

The Department

Chairman of the Department: M.E. Marshall
Departmental Supervisor of Graduate Studies: Hymie Anisman

The Department of Psychology offers a Ph.D. program which emphasizes the development of research and teaching skills in psychology and its history. Also available is a Master's program which is directed primarily toward preparation for doctoral study.

Graduate research and study is distributed across the life science areas of human learning, animal learning, perception, cognition, and biopsychology, and across the social science areas of developmental psychology, social psychology, and history of psychology. In addition, unique opportunities for doctoral study exist in human neuropsychology, and in developmental biopsychology.

All courses of study in the Department are strongly research-oriented though practical courses such as quantitative methods, testing, and behaviour modification are available, and students at the doctoral level are urged to qualify for summer internship placements in one of the applied settings approved by the Department: the Children's Hospital of Eastern Ontario, the Non-Medical Use of Drugs Directorate of Health and Welfare Canada, the Health Protection Branch of Health and Welfare Canada, the Rideau Regional Centre for the retarded, and the Ottawa Board of Education.

Laboratory facilities for research in physiological psychology and learning include vivaria and histology labs for small mammals, including cats, rats, and mice, as well as avians. Laboratories are equipped for monitoring various physiological and neurochemical activities, and for evaluating both appetitive and aversively motivated behaviours. Laboratories for human experimentation include equipment for the evaluation of human learning and memory, eyemovement camera, a six-channel tachistoscope and an anechoic chamber. In both human and animal laboratories, on-line computer systems (for example, PDP-83) are employed.

Observation rooms, equipped with both auditory and visual instrumentation, are available for studies in developmental and social psychology.

A nursery school on the premises, directed by the Department, provides an opportunity for studying the behaviour of young children and serves as a pool of experimental subjects.

Ordinarily, candidates will be accepted for graduate studies in psychology only if they are prepared to register for full-time study. Part-time enrollment is permitted only when the amount of work involved in the completion of the thesis does not justify full-time classification, or in the case of exceptionally well-prepared candidates in the Master's program.

All graduate students in psychology are expected to conduct research of interest to them during each year of graduate study. This requirement may be satisfied by independent research, serving as a research assistant, or by doing pilot or thesis research.

Each term, the candidate's adviser submits a written critique of research progress, along with a letter grade, and these become part of the candidate's permanent record. (Qualifying Year students are evaluated at the end of the first 12 months). In addition to research activity, candidates may be required to serve as teaching assistants.

Depending on his/her field of concentration, a candidate may be required to demonstrate an ability to read with understanding relevant technical material in a foreign language and/or to give satisfactory evidence of competence in such areas as computer techniques, electronic instrumentation, psychometrics, sampling procedures, or surgical techniques.

All students are required to take a basic graduate course in quantitative methods (Psychology 49.545). However, successful completion of a qualifying open-book examination which encompasses the material covered in the course 49.545 waives the requirement.

The Department may recommend that a graduate student be asked to withdraw from the program at any time if his or her progress in course work, research, or comprehensive examinations proves unsatisfactory.

Qualifying Year Program

Occasionally, candidates with exceptional promise who offer less than Honours B.A. status may be admitted to a Qualifying Year program, approved by the Graduate Studies Committee, and designed to prepare them for Master's study. A minimum grade of B– must be obtained in each Qualifying Year course, and candidates may be required to complete satisfactorily the equivalent of an Honours B.A. thesis.

Master of Arts

Admission Requirements

The normal requirement for admission into the Master's program is an Ontario Honours B.A. with second-class standing (or its equivalent) with credit in the following areas: statistics and design of experiments; experimental psychology; learning or motivation; physiology and/or comparative psychology; history and/or systems; and two or three additional courses in psychology.

Candidates with particular course deficiencies may be required to register in additional courses at Carleton.

Scores on the Graduate Record Examination (Aptitude and Advanced) are required at the time of application.

Program Requirements

The Master's program usually consists of three full courses (or the equivalent), of which at least two must be at the graduate level (numbered 500 or higher), and a thesis (equivalent to two full courses) which must be defended at an oral examination.

Academic Standing

A grade of B– or better is required in each of the five courses counted for credit towards the M.A. degree.

Doctor of Philosophy

Admission Requirements

The requirements for admission to Ph.D. programs are outlined in the general section of this Calendar.

Applicants should note that of the B.A., M.A., and Ph.D. degrees in psychology, only two may ordinarily be taken at Carleton University.

Program Requirements

The minimum program requirements for the Ph.D. degree in psychology are as follows:

- Ten full course credits; a minimum grade of B– must be obtained in each course.
- a thesis, equivalent to four or five of the required ten full course credits;
- A major area of specialization must be selected in which not less than six nor more than seven and one-half full course credits (including the thesis) may be offered in fulfillment of the ten-course requirement.

Comprehensive Examinations

All Ph.D. candidates are required to pass written and oral examinations in their area of specialization. Three optional forms for the written comprehensive are: seven short essays, two major essays, or one major essay and one research grant proposal.

The oral comprehensive examination will be undertaken not less than one week and not more than three weeks after the written section. The purpose of the oral is to give the student an opportunity to expand on the answers and solutions submitted in the written examination.

Graduate Courses*

• Psychology 49.500F1
Systems of Psychology
Historical research methods on the study of psychological movements and problems of the late nineteenth and early twentieth centuries; may be repeated for credit.
(Open with permission to advanced undergraduates)

• Psychology 49.501W1
Problems in the History of Psychology
A study of one or more selected topics in the history of man's attempt to understand his own nature; may be repeated for credit.
(Open with permission to advanced undergraduates)

• Psychology 49.510F1
Research Methods in Social Psychology I
Experience with research and data analysis techniques of particular relevance for social psychology, such as sampling, attitude scaling, and measurement. Normally required of students writing a thesis in social psychology.

• Psychology 49.511W1
Research Methods in Social Psychology II
Current ethical and methodological issues in social psychological research, such as experimental effects, deception, and subject variables. Normally required of students writing a thesis in social psychology.

• Psychology 49.523F1
Seminar in Physiological Psychology I
Selected classical and contemporary issues in physiological psychology, with emphasis on perceptual and motor processes. Normally required of students writing a thesis in physiological psychology.

• Psychology 49.524W1
Seminar in Physiological Psychology II
Selected classical and contemporary issues in physiological psychology, with emphasis on motivation, emotion and learning. Normally required of students writing a thesis in physiological psychology.

• Psychology 49.530W1
Perceptual Processes
Theoretical and empirical issues and implications of the area of perception, with attention to psychophysics, information processing, physiological mechanisms, and the ontogeny of perception.

• Psychology 49.545T2
Quantitative Psychology
A problem-oriented approach to graphic methods, statistical estimation, correlation techniques, regression analysis, chi-square, other selected non-parametric techniques, and analysis of variance. Computer techniques will be integrated with the course content.

• Psychology 49.546F1
Advanced Methodology
An in-depth exposure to various methodological and statistical problems related to students' chosen areas of specialization; to examine in detail and gain experience with various statistical programs such as SPSS.
Prerequisite: Computing Science 95.101.

• Psychology 49.547F1
Tests and Measurements
The administration and use of representative psychological tests.
Prerequisite: Psychology 49.330.

• Psychology 49.551F1
Developmental Psychology I
A detailed examination of selected issues in developmental psychology.

• Psychology 49.552W1
Developmental Psychology II
A continuation of 49.551.

• Psychology 49.561W1
Contemporary Research in Personality
Current controversial issues in personality research and selected theoretical and research studies in personality.

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

• Psychology 49.570F1
Research Methods in Learning
Methods, research design and instrumentation in the fields of learning and retention, with emphasis on response definition and measurement, procedures for monitoring the learning process, and problems of control.

• Psychology 49.573W1
Human Learning
A discussion of selected topics within the area of human learning.

• Psychology 49.575F1
Behaviour Modification I
The basic principles of learning as they apply to the modification of behaviour, with emphasis on application, ethics, research and methodology.

• Psychology 49.576W1
Behaviour Modification II
Special problems, topics, and projects related to behaviour modification.
Prerequisite: Psychology 49.575.

• Psychology 49.580F1, W1, S1
Special Topics in Psychology
The topics of this course will vary from year to year and will be announced in advance of the registration period.

• Psychology 49.590F1, W1, S1
Directed Studies
An investigation in depth of selected problems in psychology by means of directed library research. Registration is restricted, permission to register being granted only by the Graduate Committee. A final report must be filed in the Departmental office prior to submission of course grade.

• Psychology 49.591F1, W1, S1
Independent Research
Permission to register and approval of research plan must be obtained from the Graduate Committee. A final research report must be filed in the Departmental office prior to submission of course grade. The course may be repeated for credit.

• Psychology 49.599F4, W4, S4
M.A. Thesis

• Psychology 49.610F1
Research Seminar in Social Psychology I

• Psychology 49.611W1
Research Seminar in Social Psychology II

• Psychology 49.612F1
Experimental Hypnosis
Selected issues in the study of experimental hypnosis will be critically reviewed. The problem of hypnotic susceptibility and its correlates will be given particular attention. Relationships among hypnotic phenomena, meditation, and behaviour therapy will be evaluated.

• Psychology 49.620F1
Research Seminar in Physiological Psychology I

• Psychology 49.621W1
Research Seminar in Physiological Psychology II

• Psychology 49.626F1
Comparative Psychology
Varied and acquired adaptive mechanisms and their phylogenesis. Topics will include attachment behaviour, social organization, learning abilities, communication and motivation.

• Psychology 49.650F1
Research Seminar in Developmental Psychology I

• Psychology 49.651W1
Research Seminar in Developmental Psychology II

• Psychology 49.661F1
Seminar in Human Neuropsychology I
A broad and intensive consideration of selected topics in human neuropsychology, integrating findings from psychology with related medical literature.

• Psychology 49.662W1
Seminar in Human Neuropsychology II
(Same description as 49.661)

• Psychology 49.663F1
Seminar in Human Neuropsychology III
(Same description as 49.661)

• Psychology 49.664W1
Seminar in Human Neuropsychology IV
(Same description as 49.661)

• Psychology 49.665F1
Comparative Neuropsychology
An examination, from a comparative perspective, of research and logic associated with the study of brain-behaviour relations. The objective of the course is to provide a background and orientation for evaluating infra-human research of brain-behaviour relations and for relating such research to problems of human neuropsychology.
W.G. Webster.

• Psychology 49.666W1
Human Communication Disorders
The course provides an overview of normal and abnormal functions of the auditory system, particularly as it relates to the perception of human speech sounds. Diagnosis of clinical syndromes will be covered.

• Psychology 49.667W1
Developmental Psychopharmacology
The synthesis and metabolism of various neurotransmitters are detailed with respect to their role in behaviour modulation. The ontogeny of these systems are considered, as are behavioural changes which occur as a consequence of aberrant neurochemical activity.

• Psychology 49.670F1, W1
Research Seminar in Learning

• Psychology 49.675W1
Teaching Techniques in Psychology
Designed for persons pursuing a career in academic psychology. Literature on teaching effectiveness is examined and students are given experience in the preparation of classes and course planning.

• Psychology 49.680F1, W1
Special Topics in Psychology
(Same description as 49.580)

• Psychology 49.690F1, W1, S1
Directed Studies
(Same description as 49.590)

• Psychology 49.691F1, W1, S1
Independent Research
(Same description as 49.591)

• Psychology 49.699F, W, S
Ph.D. Thesis

Through inter-university cooperation in graduate instruction, full-time graduate students registered in the Department of Psychology may enroll in one course at the University of Ottawa.

The School

Director of the School: G.B. Doern
Supervisor of Graduate Studies:
Eugene Swimmer

The School of Public Administration was established in 1953 through the assistance of a generous grant from the Atkinson Charitable Foundation.

The School offers two graduate programs of study and research in the field of administration. Prospective applicants are urged to evaluate these two opportunities carefully in order that they may select the one most suitable to their interests, background and academic qualifications.

Diploma in Public Administration (D.P.A.)
This diploma program, which consists of five full courses or the equivalent, is more fully described below. It is designed to offer those persons in (or planning to enter) administrative careers an opportunity to begin acquiring some introductory exposure to subject matter related to administrative studies.

Master of Arts
The M.A. program is designed to provide a balanced exposure to both administrative studies and public policy. It is more fully described on the following pages.

Inquiries and requests for further information may be directed to the School.

Graduate Diploma in Public Administration

The Diploma in Public Administration is designed to offer those persons in, or planning to enter administrative careers an opportunity to begin acquiring some introductory exposure to subject matter related to administrative studies. The program consists of five courses and may be taken on a part-time, mid-career or full-time basis.

The program is based on the recognition that persons with widely varying backgrounds will enter it. Students who successfully complete the D.P.A. program may apply for admission to the M.A. program, at which time they will be considered for admission along with all other applicants. If all of the first-year courses are not taken as part of the D.P.A., they will be required in addition to the final year M.A. courses.

Admission Requirements

Admission to the graduate program in Public Administration is selective. To be considered for admission, an applicant must have a Bachelor's degree with at least second-class standing from a recognized university, and must have completed courses in introductory economics (Economics 43.100 or 43.101, or the equivalent) and Canadian Government and Politics (Political Science 47.200 or equivalent). If an applicant has not completed the economics and political science prerequisites, they must be completed in addition to the student's program. A grade of C or better must be obtained in the prerequisites. All students who have completed the prerequisites (particularly if completed several years ago) will be expected to have a working knowledge of the material in the prerequisite courses.

Program Requirements

The program consists of five full course credits, at least four of which must be completed at Carleton. Advanced standing may be granted in one full course (or equivalent) if previous work is judged to be equivalent to courses required in the program. A student who has taken one (or more) of the other required courses prior to admission must substitute another course (or courses) in consultation with the Director. In the event that a part-time student is required by his employer to move away from Ottawa, he may apply to complete one full course or the equivalent at another university, provided that no transfer of credit was granted on admission

Students are required to complete any five full courses from the following program:

- Administration 50.510, Management Accounting and Administration and 50.511, Financial Management;
- Administration 50.522, Economics for Management and Policy I and Administration 50.523, Economics for Management and Policy II;

- Administration 50.530, Organizational Behaviour I and Administration 50.531, Organizational Behaviour II;
- Administration 50.536, Law of Public Authorities I;
- Administration 50.500, Public Sector Managing and the Canadian Political System;
- Administration 50.567, Public Sector - Private Sector Relations;
- Administration 50.568, Policy and Decision Making;
- Administration 50.550, Quantitative Methods.

Part-time students already admitted to the D.P.A. program under the provisions of previous Calendars may adjust their programs to take advantage of the revised program outlined above.

Academic Standing

All candidates are required to obtain a grade of B– or better in each course in the program. A candidate may, with the recommendation of the School and the approval of the Faculty of Graduate Studies and Research, be allowed a grade of C+ in one half-course.

Master of Arts

The Master's program is specifically designed to provide the prospective and the mid-career administrator with a balanced exposure to administrative studies and to public policy.

The contemporary manager or administrator is increasingly required to be both a policy adviser and formulator and to have a substantive understanding of the many disciplines and variables associated with the decision-making process in contemporary organizations. University programs can begin to provide some of the foundations that will enable persons to acquire an understanding of the broad financial, legal, economic, political and social interrelationships that affect decisions in any organization.

The program is designed to prepare students for managerial, policy and managerial-support roles in the public services of Canada (federal, provincial, regional, municipal), and to accelerate and enrich the education and the development of those already performing such roles. Because it is conducted in conjunction with and draws upon a program of advanced research in administrative studies and public policy, it is also designed to meet the educational needs of those wishing to undertake graduate-level work in public policy and management, but who may not have a current commitment to public service careers.

Basic Characteristics of the Program

- *The combining of academic quality and professional relevance*

The program is a university one and at graduate level. This means that it requires of participants the academic performance and commitment of all graduate students, with admission standards reflecting this requirement. At the same time, it is a career-oriented program, emphasizing performance in extremely demanding roles in public sector organizations; as such, it reflects the direct and longer-term professional requirements of the public services.

- *The core program and public sector applications*

A key premise of the program is that public sector managerial, policy, and managerial support personnel require the rigorous foundation in the management, policy and behavioural sciences that has come to be acknowledged in business administration programs. The severe limitation of existing business administration programs, in preparing students for public sector roles, is that the core program is understandably related, in subsequent studies, to business sector concerns, issues and institutions. An M.B.A. graduate normally brings to the public sector a highly useful set of skills, techniques and approaches, primarily because he has had the rigorous foundations program. By following the Master's program in public administration, a graduate will bring this foundation, but with valuable additional strengths acquired from a full year of disciplined application of the core program to public sector concerns.

- *A stress on developmental experiences*

The program recognizes that educational experiences taking place within a university are a complement to, rather than a substitute for, practical work experience in terms of the development of potential.

Optimum development towards potential is seen as sequential, cumulative, and continuous: it can start at any career point, either in the work situation or in a formal education program; at some point, however, an effective alternation of on-the-job experiences and formal education is required. This is recognized in three ways: students without prior work experience are encouraged to accept internships within the public services as a regular component of their programs; special stress is placed on the Mid-Career Program (described in detail below), a degree program based on considerable prior work experience; in addition, the "on-campus" requirements are such that less time away from the work situation is required. The program also seeks to blend academic excellence with the insights coming from the working environment: through the teaching materials used, through faculty experiences in public sector research or assignments, and through involving public servants in seminar leadership and teaching roles.

• *The resources of the national capital*

The academic staff and the students in the School reflect a broad cross-section of disciplines and backgrounds. This is an important feature of the opportunities available, inasmuch as the programs are intended to expose students with varying backgrounds to a basic understanding of the contribution of the core disciplines.

The School of Public Administration, because of its location in Ottawa, is able to provide the student with a unique exposure to the resources and personnel located in the national capital. The study of public administration and public policy can be pursued with a total range of resources not readily available in other locations.

The School cooperates fully with the Faculty of Management Sciences at the University of Ottawa. Many courses offered at the University of Ottawa may be taken as part of the students' optional second-year courses. Thus, a cooperative joint program in public policy and management is available, drawing upon the combined resources of the two universities.

All students already admitted to the Master's program on the basis of previous Calendar requirements may continue their program according to the terms of their current Statement of Standing on Admission. Students should contact the Director of the School if they are in doubt as to their status or their remaining program requirements.

Degree Schedules

The degree can be taken in one of three basic ways: full-time, part-time, or through a special Mid-Career Program. It is also possible for the individual student to combine elements of all three approaches. The three schedules are as follows:

• The Full-time Schedule

A student attending full time will normally complete the program in two years. The program can be completed in two years or four academic terms (each of approximately 13 weeks duration), but typically the full-time student will require part of a fifth (usually summer) term to complete the program, depending upon the amount of advanced standing given for previous courses.

• The Part-time Schedule

Courses are offered on a part-time basis; a part-time student normally completes from two to four half-courses during the regular academic year, through evening courses or by joining regular day-time courses. Certain part-time courses are scheduled during the summer term. The duration of a part-time program, therefore, normally varies from five to eight years.

• Mid-Career Schedule

To qualify for the mid-career program, a student must have spent several years in one of the public services, or performing managerial or related functions in a private-sector organization. The student must also meet the admission requirement for entry to the graduate program; while the *schedule* is different from the full-time program, in matters of expected levels of academic performance, the two programs are identical.

What is unique about the program is that it combines elements of the full-time and part-time programs, while adding a special directed studies component on a schedule built around the expectation that students will alternate periods of intensive study with their normal work. The schedule comprises the following: *A Residential Semester*, lasting 12-13 weeks,

during which mid-career students complete five half-courses;
A Normal Work Period, during which students normally complete four half-courses, through part-time studies or special "directed studies" courses. In a "directed studies" course, students are not required to attend the normal on-campus University courses, working instead in a close individual relationship with a professor on a schedule mutually agreed upon.
A Second Residential Semester, again lasting 12-13 weeks, during which five half-courses are required;
A Normal Work Period, during which students will complete the remaining six half-courses of the graduate degree.

Admission Requirements

To be considered for admission, an applicant must have a Bachelor's degree or equivalent with at least second-class standing from a recognized university, and must already have completed courses in introductory economics (Economics 43.100 or 43.101 or equivalent) and Canadian government (Political Science 47.200 or equivalent).

If an applicant has not completed the economics and political science prerequisites, they must be completed in addition to the student's program. A grade of C or better must be obtained in the prerequisites. All students who have completed the prerequisites (particularly if completed several years ago) will be expected to have a working knowledge of the material in the prerequisite courses.

The School's admission policy will, of course, be governed by the availability of graduate student space and the need to admit applicants from a variety of disciplines and backgrounds (for example, social sciences, humanities, law, engineering, science). Possession of the minimum admission requirements does not, in itself, guarantee acceptance.

Advanced standing may be granted for required courses only if previous work is judged to be equivalent to courses required in the program. Advanced standing and transfer of credit must be determined on an individual basis in consultation with the director, and must also be approved at the time of admission by the Dean of the Faculty of Graduate Studies and Research. In general, a grade of B- or better is required in equivalent courses to obtain advanced standing.

Program Requirements

The M.A. program comprises 20 half-courses (or the equivalent).

Students generally begin their program with required courses. It is possible, however, to take a mixture of optional and required courses throughout both years, provided that the student has the necessary prerequisites for any specific options selected.

Required Courses

- Admin. 50.500 Public Sector Managing and the Canadian Political System
- Admin. 50.510 Management Accounting
- Admin. 50.511 Financial Management
- Admin. 50.522 Economics for Management and Policy I
- Admin 50.523 Economics for Management and Policy II
- Admin. 50.530 Organizational Behaviour I
- Admin. 50.531 Organizational Behaviour II
- Admin. 50.536 Law of Public Authorities I
- Admin. 50.550 Quantitative Methods
- Admin. 50.567 Public Sector - Private Sector Relations
- Admin. 50.568 Policy and Decision Making

Students who have successfully completed the requirements for the Diploma in Public Administration and who are unable to continue their M.A. program, may be awarded the Diploma, provided that four full courses have been taken at Carleton University.

Optional Courses

- three half-courses, one selected from each of the first three streams listed below; (this rule may be waived for students doing a thesis).
- five half-courses (or equivalent) selected from any of the course streams listed below, OR
- a thesis (equivalent to four half-courses) and one half-course option, OR
- a research essay (equivalent to two half-courses) and three half-courses.

Note: Courses with MSG prefixes are offered by the Faculty of Management Sciences at the University of Ottawa.

Public Policy Stream

Administration
50.501 Policy and Administration in Intergovernmental Relations
50.565 Government-Industry Policy Relations
50.566 Science and Technology Policies
50.569 Advanced Policy and Decision Analysis
50.572F Policy Seminar (Health Care Policy)
50.572G Policy Seminar (Manpower)
50.573W Policy Seminar (Incomes Policy)
50.573X Policy Seminar (Nuclear Policy)
50.574 Urban Policy Analysis
50.590 Directed Studies

Economics
43.580 Urban Economics

Social Work
52.510 Social Policy

University of Ottawa
MSG Advanced Policy Analysis Workshop I

Public Sector Management Stream

Administration
50.513 Public Sector Budgeting
50.515 Public Sector Management
50.516 Urban Management
50.517 Management in Developing Countries
50.537 Law of Public Authorities II
50.562 Planning in Government I
50.563 Planning in Government II
50.583/MSG 6111 Problems in Organizational Change and Development
50.590 Directed Studies

Law
51.555 Administrative Law II

Political Science
47.540 Problems in Canadian Public Administration
47.544 Public Administration in Developed Western Countries

Social Work
52.541 Management of Social Programs
52.551 Program Evaluation

Specialist Functional Stream: Personnel, Finance, Marketing, Operations Research

Administration
50.512 Management Information Systems
50.514 Public Sector Accounting and Finance
50.551 Analytical Methods for Policy Analysis
50.581 Staffing and Personnel Management
50.584 Industrial Relations and Collective Bargaining
50.585 Public Sector Collective Bargaining

Economics
43.465 Industrial Relations
43.480 Econometrics

History
24.438 Selected Problems in Canadian Labour History

Law
51.441 Labour Law
51.445 Staff Relations in the Public Service

Management Studies
42.518 Marketing for Non-Profit Organizations

Sociology
53.526 Sociology of Occupations and Professions

University of Ottawa
MSG 6131 Quantitative Models for Manpower Planning
MSG 6317 Manpower Resources Policy
MSG 6161 Seminar on Behavioural Sciences
MSG 6103 Managerial Accounting II
MSG 6115 Managerial Economics III
MSG 5106 Operations Research I
MSG 5108 Operations Management
MSG 5116 Operations Research II
MSG 6112 Linear Programming and its Applications
MSG 6113 Decision Theory
MSG 8901 Networks Analysis
MSG 6116 Stochastic Processes in Operations Research
MSG 8902 Selected Topics in Operations Research
MSG 5109 Marketing I
MSG 6109 Marketing Research
MSG 6154 Models in Marketing

Government-Industry Relations Stream

Administration
50.565 Government-Industry Policy Relations
50.566 Science and Technology Policies
50.572X Policy Seminar (Nuclear Policy)
50.572W Policy Seminar (Incomes Policy)

Economics
43.410 Finance and Capital Markets
43.430 Industrial Organization and Public Policy

International Affairs
46.530 The International Enterprise

Sociology
53.529 Sociology of Science and Technology

Urban and Intergovernmental Relations Stream

Administration
50.501 Policy and Administration in Intergovernmental Relations
50.517 Urban and Local Government Management
50.574 Urban Policy Analysis

Economics
43.440 Public Finance
43.580 Urban Economics

Geography
45.445 Land Resource Use

Political Science
47.409 French-Canadian Politics
47.450 Federalism
47.500 Problems of Canadian Local Government and Politics
47.501 Problems of Canadian Provincial Government and Politics
47.502 Comparative Local Government

International and Comparative Administration Stream

Administration
50.517 Public Management in Developing Countries

Economics
43.460 International Trade

Geography
45.520 Spatial Aspects of Development - Africa
45.521 Spatial Aspects of Development - Asia

International Affairs
46.500 International Integration
46.505 Political and Economic Development
46.530 The International Enterprise

Law
51.420 International Economic Law I
51.421 International Economic Law II
51.463 Public International Law

Political Science
47.544 Public Administration in Developed Western Countries
47.545 Public Administration in Developing Countries
47.561 Development of Canadian External Relations
47.562 Issues in Canadian Foreign Policy
47.597 Problems in International Organization

Academic Standing

All candidates are required to obtain a grade of B– or better in each course in the program. A candidate may, with the recommendation of the School and the approval of the Faculty of Graduate Studies and Research, be allowed a grade of C+ in one half-course.

First Year Courses*

• Administration 50.500F1
Public Sector Managing and the Canadian Political System
An examination of the central features and influences of the Canadian political system on public service managerial and policy roles. An examination of the application of managerial

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

concepts and approaches in Canadian public administration.
Prerequisite: Political Science 47.200.
V.S. Wilson.

• Administration 50.510F1
Management Accounting
An introduction to the underlying assumptions and basic principles of accounting and an examination of the uses of accounting information by management. Topics include income measurement, asset valuation, financial statement analysis, cost systems, control reports, operating budgets, capital expenditure decisions, and alternative choice problems.
Allan Blair.

• Administration 50.511W1
Financial Management
An examination of the principles and practice of financial planning and control. Analysis of the problems of resource allocation and asset management under conditions of uncertainty. Techniques of capital expenditure analysis, and analysis of funds flow.
Prerequisite: Administration 50.510 or permission of the instructor.
Eldon Gardner.

• Administration 50.522W1
Economics for Management and Policy II
An examination of the concepts and uses of macro-economic theory and methods in total social resource allocation, including fiscal and monetary policy.
Prerequisite: Economics 43.101.

• Administration 50.523F1
Economics for Management and Policy I
An examination of the concepts and uses of micro-economic theory and methods in organizational resource allocation.
Prerequisite: Economics 43.101.
A.M. Maslove.

• Administration 50.530F1
Organizational Behaviour I
An examination of basic theories and approaches to the motivation of workers in organizations, the analysis of individual behaviour in organizations from the perspective of worker motivations, and the examination of current tools such as job enlargement participation models and M.B.O. for improving worker motivation and coping with organizational change.
D.G. Swartz.

• Administration 50.531W1
Organizational Behaviour II
An examination of organizational behaviour from an open-systems perspective which focuses on the organization as a whole. Focus will be on topics such as coordination and control, authority and power, conflict and cooperation between organizations and interactions between organizations and their various constituencies.
Prerequisite: Administration 50.530.

• Administration 50.550T2
Quantitative Methods
An introduction to the theory of measurement and various methods of data collection and causal analysis. Under the guidance of the instructors, students are expected to devise their own research designs, and analyze empirical data with the use of the computer.
Eugene Swimmer.

• Administration 50.567W1
Public Sector - Private Sector Relations
An examination of basic theories and interpretations regarding the roles of, and interrelationships among the state, corporations, labour unions, the professions and other elements of the private sector.
Prerequisite: Administration 50.500.
G.B. Doern, I.H. MacDonald, D.G. Swartz and V.S. Wilson.

Second Year Courses

• Administration 50.501T2
Policy and Administration in Intergovernmental Relations
An examination of the major cost-sharing and fiscal transfer agreements, and the intergovernmental mechanisms for policy and administrative coordination. Also examined are selected substantive program areas such as immigration, cable television, manpower training, regional economic development, energy and natural

resources and other contemporary topics.
Prerequisite: Administration 50.500 or permission of the instructor.
I.H. MacDonald.

• Administration 50.512T2
Management Information Systems
An examination of information and decision networks of complex organizations, including general systems theory and information theory concepts, decision models and specifications of information requirements, systems analysis and sub-system modules, and hardware and software considerations.
Prerequisites: Administration 50.510, 50.511 or permission of the instructor.
Allan Blair.

• Administration 50.513W1
Public Decision Making and Budgeting
An examination of public sector decision-making processes and instruments (for example, cost-benefit analysis, PPBS, indicators) from a mainly economic perspective. A portion of the course is devoted to the examination of federal and provincial budgets viewed as policy outcomes of the decision-making process.
Prerequisite: Administration 50.523.
A.M. Maslove.

• Administration 50.514W1
Public Sector Accounting and Finance
An examination of selected problems in accounting and financial management in public sector organizations.
Prerequisites: Administration 50.510 and 50.511.
Roy Gunn.

• Administration 50.515F1
Management in the Public Service
An examination through cases and research of selected problems and issues in public service management. The specific focus of the course will change each year. Some topics include human resources management, government investment and pricing decisions.

• Administration 50.516W1
Urban and Local Government Management
An analysis of the principal issues and processes of Canadian urban and local government management and administration.
Prerequisite: Administration 50.500.

• Administration 50.517W1
Public Management in Developing Countries
An applied analysis of selected issues in public management and administration in developing countries.
Prerequisite: Administration 50.500.
J.R. Nellis.

• Administration 50.536F1
Law of Public Authorities I
Introduction to basic legal principles, structures and processes for the public administrator. Character of law and public law; constitutional framework; legal sanctions and basic principles of legal control. Statutory discretion from the administrator's point of view.
R.D. Abbott.

• Administration 50.537F1
Law of Public Authorities II
Characteristics and problems of control of administrative action. Varieties of legal control, judicial review, discretion, privative provisions and damages, appelate control, statutory reform.
Prerequisite: Administration 50.536.

• Administration 50.551T2
Analytical Methods for Policy Analysis
An introduction to the techniques of operations research and their applications to problem solving in government. Techniques to be discussed include optimization, linear programming, stochastic processes, queueing theory, and decision analysis.
Mathematical prerequisite: high school algebra.

• Administration 50.562F1
Planning in Government I
An introduction to selected concepts, issues and circumstances in applied governmental planning.

• Administration 50.563W1
Planning in Government II
A further examination of governmental planning, using cases and simulations.
Prerequisite: Administration 50.562.

• Administration 50.565T2
Government-Industry Policy Relations

An examination of the main policies, programs and strategies of those government departments (federal and provincial) which have the most direct interface with the industrial and corporate sector in Canada. These departments include Industry, Trade and Commerce, Treasury and Economics, Consumer and Corporate Affairs, etc.
Prerequisites: Administration 50.523 and 50.567.
G.B. Doern and C.J. Maule.

• Administration 50.566S1
Science and Technology Policies
An examination of Canadian programs, policies and strategies toward the development of scientific and technological capability and towards the use of science and technology in social and economic programs.
Prerequisite: Administration 50.500, 50.567, and 50.568 or permission of the instructor.
G.B. Doern.

• Administration 50.568F1
Policy and Decision Making
An examination of policy and decision-making theories and processes. The course examines the processes of formulating objectives and of making decisions under conditions of relative certainty and uncertainty. Policy and decision theory and processes in the public and private sectors are compared and contrasted.
Prerequisite: Administration 50.500.
G.B. Doern and R.J. Van Loon.

• Administration 50.569W1
Advanced Policy and Decision Analysis
An analysis of advanced concepts in policy and decision analysis drawing upon organizational, political and economic analysis.
Prerequisite: Administration 50.568, 50.530/531 or permission of the instructor.

• Administration 50.572F1, W1, 50.573S1
Policy Seminars
An examination of one or more selected policy areas. The focus will be an analytical assessment of the selected policy area in terms of its many-sided economic, political, social, legal, quantitative and administrative complexities. The policy field will change each year.
50.572: Health Care Policy and Manpower
50.573: Incomes Policy and Nuclear Policy
Prerequisites: Administration 50.568 and 50.523 or permission of the instructor.
G.B. Doern, D.G. Swartz and R.J. Van Loon.

• Administration 50.574F1
Urban Policy Analysis
An analysis of the urban policies of all three levels of government in Canada and their interactions. The course examines policy processes as well as a number of substantive urban policy issues.
Prerequisite: Administration 50.523.
A.M. Maslove.

• Administration 50.581W1
Staffing and Personnel Management
An examination of the staffing and personnel-management functions in large public and private organizations, including recruitment, selection, and performance appraisal, reward systems, and the roles of staffing professionals.

• Administration 50.583F1
Problems in Organizational Change and Development
An examination, through case work and group projects, of the concepts and issues of planned organizational changes.
Prerequisites: Administration 50.530 and 50.531 or permission of the instructor.

• Administration 50.584F1
Industrial Relations and Collective Bargaining
An analysis of the basic concepts of industrial relations with respect to both public and private sector employees and organizations.
Eugene Swimmer.

• Administration 50.585W1
Public Sector Collective Bargaining
An application of the basic concepts, legislation and public policies regarding public sector collective bargaining at the federal, provincial and municipal levels of Canadian government. Cases and simulated negotiations will be used where appropriate.
Prerequisite: Administration 50.584 or permission of the instructor.
Eugene Swimmer.

• Administration 50.590T2
Directed Studies

A tutorial or directed reading course on selected subjects.

- Administration 50.591F1, W1, S1
Directed Studies
A tutorial or directed reading course on selected subjects.

- Administration 50.598F2, W2, S2
Research Essay

- Administration 50.599F4, W4, S4
M.A. Thesis

The School

Director of the School: S.J. Albert
Supervisor of Graduate Studies: Peter Findlay

The School of Social Work offers a graduate program leading to the degree of Master of Social Work. The program may be completed through full-time or part-time study.

Master of Social Work

The Master of Social Work program is based on an analytical and critical approach to social work practice and to knowledge related to practice. The program examines the structural context of personal and social problems and of social work practice. The structural context refers to the interaction between the personal and the social, political and economic aspects of such problems. The program focuses on the development of forms of practice predicated on this notion - referred to as structural approaches - seeking to intervene to change the nature of the interaction between people and their structural context.

The School's orientation explicitly includes approaches to social problem solving, social development and social change, which involves working directly with individuals and groups. This includes a strong emphasis on sensitivity to the individual and on the development of new and innovative strategies for working with individuals in their environments. The School also stresses community analysis and an awareness and knowledge of the social policies that effect the lives of many people in our society.

The program of the School offers two major social work intervention areas. The first area is related to direct practice with individuals, families, groups and communities. Pressures of society are contributing to the toll of family and individual suffering. Traditional primary institutions such as the family are undergoing modification, and in many cases they no longer provide needed support. It is hoped that skilled social work practitioners can help families, individuals and communities through some of the crises, and help them effectively to address the personal and societal pressures they are facing.

The second major area of study is social administration and policy. There is a growing awareness that social work should be more involved in the development of social policies, in the operation of large scale social programs and in policy analysis and research. Since the School is well situated in the nation's capital, it has a wealth of resources in the social policy and program arenas to draw upon.

The program includes the following major curriculum segments:

- an understanding of social structure and individual and collective behaviour;
- an understanding of the methods and processes of social work intervention;
- an understanding of the social policy process and social work's participation in it;
- research knowledge and skills and their application to questions dealing with social work practice, with particular emphasis on the evaluation of social work practice and of programs;
- field work, an opportunity for students to test out aspects of the academic curriculum within a practice setting and to work with professionals involved in social work and related fields.

Part-time Degree Program

The School also has a small part-time degree program in operation. A limited number of candidates are admitted to this program each fall. It is anticipated that the part-time program will attract competent candidates who, due to a range of circumstances, cannot participate in a program of full-time study. M.S.W. requirements in the part-time program are identical to the regular program and the course offerings and timetable for part-time students are the same as for full-time students.

Admission Requirements

Admission to the School is on a selective basis.

All applicants will have received their Bachelor's degree, or be in their final year of undergraduate study prior to graduating from a recognized university; a minimum B standing at the undergraduate level is expected.

Applicants must present a one-credit course in basic research methods and should have a background in the social sciences. Preference will be given to candidates with related work experience.

Applicants with a B.S.W. degree, or graduate work in a related discipline, are considered individually for advanced standing in the program.

Application is made on the forms available from the Admissions Office at the School of Social Work; all applications should be received at the School by *February 1*.

Program Requirements

Candidates for the Master of Social Work degree must complete ten full credits of course work (or the equivalent).

First Year Requirements

A candidate must choose one of the two practice areas for concentration during the first year.

All candidates must take:

- S.W. 52.500 Human Behaviour and Structural Context
- S.W. 52.510 History and Philosophy of Social Welfare

Candidates in Direct Intervention must take:

- S.W. 52.500 Direct Intervention
- S.W. 52.552 Evaluation of Direct Intervention and one course (half-credit) from S.W. 52.521 to 52.529.

Candidates in Social Administration and Policy must take:

- S.W. 52.540 Social Administration and Policy
- S.W. 52.551 Program Evaluation and one course (half-credit) from the following: S.W. 52.505, S.W. 52.511, S.W. 52.541, S.W. 52.542.

Second Year Requirements

All candidates must take:

- S.W. 52.561 Field Practice I
- S.W. 52.590 Independent Enquiry Project

Other Requirements

Candidates in Direct Intervention must take:

- one half-course from S.W. 52.521 to S.W. 52.529 or S.W. 52.501 to S.W. 52.509;
- one half-course from S.W. 52.511 to S.W. 52.519;
- either a second field placement (second year only) or four optional half-credit courses (or equivalent);
- one half-credit optional course.

Candidates in Social Administration and Policy must take:

- one half-course from among S.W. 52.511, S.W. 52.541, S.W. 52.542 or S.W. 52.501 to S.W. 52.509;
- one half-course from S.W. 52.511 to S.W. 52.519;
- either a second field placement (second year only) or four optional half-credit courses (or equivalent);
- one half-credit optional course.

Academic Standing

The School operates within the evaluation and grading system of the Faculty of Graduate Studies and Research.

Graduate Courses*

Human Behaviour and Structural Context

- Social Work 52.500T2

Human Behaviour and Structural Context

A general framework for the utilization of social science theory in social work practice is presented, reviewing major contributions from individual and social psychology and from social, political and economic theory toward the understanding of the interaction between the personal and the larger social system aspects of problems confronted by social work practitioners.

- Social Work 52.501F1

Community Structure

Examination of various theories of community behaviour and structure, developing a general framework for understanding the complexity of

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Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

community behaviour, related to community practice.

• Social Work 52.502W1
Economics of Welfare
An examination of economic aspects of social policy critically examining several theoretical approaches to the role of government in the financing of social policy. Review of the growth of federal government spending on social welfare, and an examination of the federal tax system and selected social welfare policies.

• Social Work 52.503W1
Social Change and Social Welfare
Exploration and analysis of the major factors in social change, drawing on the relevant work of major social theorists and on writers such as Gorz, Alinsky and Freire, who have directed themselves more explicitly to issues faced by social workers.

• Social Work 52.504W1
Social Work and the Law
Examination of the legal context within which social policy is developed, social programs presented and social work practised, clarifying the philosophical basis of Canadian law, the relationship between law and the state, and the expression of the law in the judicial system. Special attention is given to a critical analysis of legislation concerning families and children.

• Social Work 52.505F1, W1
Organizational Behaviour
Examination of contemporary theories and research related to organizational behaviour and change, focused on bureaucratic and open systems theory towards the critical analysis of complex social organizations, and examining the relevance of such theory to organizations in the social welfare field.

• Social Work 52.506F1, W1
Women and Welfare
This course is designed to create general awareness of the changing status of women in Canada, with particular reference to women in social welfare programs and to the practice of social work, examining how women have been perceived by the social sciences, the societal perception of women implied in social welfare policies, and the social change impact of the contemporary women's movement.

• Social Work 52.509F1, W1
Selected Topics in Human Behaviour
Seminar on a special topic, based on current interests of faculty and students and availability of special expertise, presented by a faculty member or a visiting professor.

Social Policy Analysis

• Social Work 52.510F1, W1
History and Philosophy of Social Welfare
An historical perspective on the development of social welfare policies and the practice of social work, presenting an analysis of such matters as the functions of welfare institutions, the historical relationships between welfare and work, the nature and terms of social provisions, the contrast between residual and institutional welfare policies, and the development of social work practice.

• Social Work 52.511F1, W1
Social Policy Analysis
Based on a framework for the analysis of social problems, the course offers conceptual, theoretical and empirical tools for the analysis of social policies in meeting social needs or resolving social problems in Canadian society.

• Social Work 52.513F1
Personal Social Services
Examination of a number of issues related to personal social services, including government jurisdiction, financing, access, rationing, present organizational structures and the nature of services provided. Major current developments are examined and a perspective on the future of personal social services developed.

• Social Work 52.514F1
Housing Policy
An introductory analysis of the economic and social aspects of housing. Issues include the nature of property, housing finance and construction, rent control, land assembly and de-

velopment, and housing rehabilitation; also covers the genesis and current state of housing policy at all three levels of government, and the effect of government policy on the distribution of housing.

• Social Work 52.515F1
Poverty and Wealth
Critical examination of theories of poverty and wealth, in an attempt to explain the existence of poverty and the unequal distribution of income and wealth in Canada, then using the perspective developed to focus on existing and prospective Canadian social policies, such as guaranteed annual income schemes and wealth taxation.

• Social Work 52.518F1
Seminar on a Selected Service Field
In any one year, two additional half-credit social policy analysis courses may be offered focusing on particular fields of service, such as corrections, mental health services, children's services or health care services, examining current programs, historical developments, and the major current issues or developments.

• Social Work 52.519W1
Seminar on a Selected Service Field
(Same description as 52.518)

Direct Intervention
• Social Work 52.520F2
Direct Intervention
Presentation of a structural framework for social work practice consonant with the changing paradigm underlying the profession over the past decade, articulating a model of practice, and examining the following aspects of the framework: assessment and interventive approaches; development of analytical and interactional skills; the helping process. Research questions and implications will be continually identified.

• Social Work 52.521F1, W1
Individual and Family Intervention
The development of practice knowledge and skill related specifically to intervention with individuals and with families, examining the implications for assessment and intervention of a structural approach to working with individuals and families and directing attention to the differential use of current techniques of intervention.
Prerequisite: Social Work 52.520.

• Social Work 52.522F1, W1
Models of Practice with Individuals and Families
Comparative and critical analysis of contemporary models, that is, "approaches", "intervention methodologies", etc. currently proposed in direct practice. An analytical framework is presented which examines the problems of selection and relevance of such models for a structural approach to practice.

• Social Work 52.523F1, W1
Principles of Group Development
Group development refers to the changes through time in the internal structures, processes and culture of the group. Based on the assumption that the group is a vehicle in all practice modalities, and that the role of the group leader is that of developing the group to do its own work, the course draws on small group theory and group practice theory.

• Social Work 52.524W1
Differential Application of Group Development
Examination of the application of group development skills in a variety of settings with the concept of group development as a unifying theme; identifying significant interactional variables to form a comparative framework. The student will acquire knowledge in breadth, pertaining to the differentiation of group contexts, as well as knowledge in depth pertaining to a selected group context.
Prerequisite: Social Work 52.523 or equivalent.

• Social Work 52.525W1
Building an Organization
The theory and practice of organizing for social action in a variety of contexts: at the theoretical level, the concern will be when and on what basis to organize. Specific attention is then given to organizing at the community and the institutional levels, and organizing national pressure groups around social policy issues. The development of skills in contacting the potential constituency, in constitution-making and running meetings, negotiating, fund raising, public relations, building support among members,

and planning effective actions to achieve or publicize organizational aims will be undertaken.

• Social Work 52.526W1
Models of Community Practice
Presentation of a framework for analysis of community problem definition, and working this through goal setting, decision making, action strategies, tactics and evaluation, affording a detailed examination of four major community intervention roles: enabler, organizer, developer, and advocate. The concept of citizen participation is also examined.

• Social Work 52.527F1
Case Studies in Community Practice
Concerned with community action in Canada, based on case studies of Canadian experiences, and providing a broad perspective of the types of citizen action and intervention in community processes; emphasis will be placed on practice, relating concepts developed to the past, present, and emerging reality of community work in Canada.

• Social Work 52.529F1, W1
Foundations of Direct Intervention Practice
Tracing the evolution of the paradigm underlying contemporary social work practice with individuals, families, and collectivities, the course examines the effects and practice implications of a social action *versus* a disease model of practice, a multicausal *versus* a linear model of causality, a system model of practice based on ecological *versus* clinical perspectives, and the shifting meaning of the concept of social functioning and the profession's historical efforts to remain scientific.

Social Administration and Policy
• Social Work 52.540F2
Social Administration and Policy
An introductory methods course providing an understanding of the values and knowledge required for the effective performance of policy and planning roles in organizational and community settings, covering need assessment as well as administrative, policy and planning methods with an emphasis on social welfare and health agencies as the system context for practice.

• Social Work 52.541W1
Management of Social Programs
Development of intervention and analytic skills through concern with the nature of management in the public and voluntary sector, approaches to more effective utilization of organizations and more effective mechanisms for the delivery of human services. Topics include managerial effectiveness, decision-making methods and tools, models of managerial behaviour and the design of resource requirements, including budget development.
Prerequisite: Social Work 52.540.

• Social Work 52.542W1
Multi-Level Policy Intervention
To ensure that students have a comprehensive understanding of the uses of social system theory in social problem analysis and solution, students are introduced to large-scale social system analysis, macro-level decision theory, indicators of social system status and structural level research processes and findings; acquaints students with notions of system balance, system contexts for policy development and problem solving and multiple-level policy options and intervention.
Prerequisite: Social Work 52.540.

• Social Work 52.549W1
Special Seminar in Social Work Intervention
A special half-credit seminar in intervention may be offered each year on a particular topic relevant to current interests of faculty and students (or a visiting professor) in either Direct Intervention or Social Administration and Policy.

• Social Work 52.551W1
Program Evaluation
Relying on principles of basic research methods, this course will focus on the issues of planning and conducting research which aims to determine the effects of social programs. Topics include purposes of evaluative research, articulating program components, goal specification, development of measures, experimental and quasi-experimental design, and utilization of findings.

• Social Work 52.552W1
Evaluation of Direct Intervention
Development of a beginning awareness of

issues and skills involved in the evaluation of intervention with individuals, families, small groups, and communities. Moving from philosophical and socio-political research perspectives, the seminar focuses on the development of evaluative criteria and analytical frameworks which could be used to determine the relevance and the effectiveness of intervention.

Field Practice

• Social Work 52.561F4, W4, S4
Field Practice I
The field placement facilitates the integration of the academic and practical aspects of social work education, providing the opportunity for students to test theory and practice models dealt with in the academic curriculum and to learn professional responsibility in self-directed learning practice skills.
The field placement consists of a minimum of 13 weeks (40 hours per week) and includes a bi-weekly field seminar.
Offered in spring term subject to availability of faculty.

• Social Work 52.562F4, W4, S4
(Same description as 52.561).

Independent Enquiry Project

• Social Work 52.590F2, W2, S2
Independent Enquiry Project
The I.E.P. is designed to contribute to the preparation of social work practitioners through the development of skills in planning and conducting research relevant to social work practice. The I.E.P. should include some common elements: formulation of a question; a rationale for the importance of the question; theoretical basis for investigating the question. Various research approaches and styles may be used. The student works with a faculty research adviser and the proposal is reviewed by a project reader.

• Social Work 52.591F1, W1, S1
Tutorial on a Selected Topic
Tutorial or reading course on a selected topic.
Offered in spring term subject to availability of faculty.

Courses Not Offered in 1978-79

52.550 Research Planning Seminar

The Department

Chairman of the Department: Dennis Forcese
Departmental Supervisor of Graduate Studies: Stephen Richer

The Department of Sociology and Anthropology offers programs of advanced study and research leading to the M.A. and Ph.D. degrees in sociology, and the M.A. in anthropology.

The principal focus of Departmental interest in sociology at the graduate level is comparative social organization, with complementary specialization in the study of social demography-ecology and theory-methodology. The research emphasis is on industrial and industrializing societies. The institutions of Canadian society, in particular, class, ethnic, political and regional structures, are examined in historical and comparative perspective.

The principal foci of the anthropology graduate program are ecological anthropology, and theory and methods in formal analysis. The latter are broadly defined to include such issues as exchange theory, behaviourist models in anthropology, decision theory, and structuralism. There is a strong ethnographic component in the program, with particular emphasis on North America and on Africa south of the Sahara.

The current activity of the members of the Department is as follows:

Comparative Social Organization

Comparative Societies
R.K. Crook, John Harp, B.A. McFarlane, Dennis Olsen, Adam Podgorecki, John Porter, George Ross, A.D. Steeves, D.R. Whyte

Comparative Institutions
Colin Farmer, D.P. Forcese, Muni Frumhartz, John Harp, F.K. Hatt, Florence Hughes, Gordon Irving, John Myles, Adam Podgorecki, John Porter, Stephen Richer, George Ross, James Vantour, F.G. Vallee

Occupations and Formal Organizations
C.C. Gordon, D.P. Forcese, F.K. Hatt, Judah Matras, Hugh McRoberts, John Porter, A.D. Steeves

Social Anthropology

Valda Blundell, J.J. Cove, B.A. Cox, Jared Keil, Charles Laughlin, Joseph Manyoni, J.I. Prattis, D.G. Smith, V.F. Valentine, F.G. Vallee

Social Demography-Ecology

Monica Boyd, Judah Matras, John de Vries

Theory-Methodology

Hyman Burshtyn, Jacques Chevalier, R.K. Crook, D.P. Forcese, B.D. Johnson, Hugh McRoberts, Gertrud Neuwirth, T.A. Nosanchuk, John de Vries, Caryll Steffens, D.R. Whyte

The Department of Sociology and Anthropology has access to the Canadian Institute of Public Opinion poll data and the Human Relations Area Files, and is a member, in cooperation with other social science departments, of the Inter-university Consortium for Political Research. Other data sets and archival holdings are also available in the Department. Because of the location in Ottawa of Statistics Canada, the National Museum, the National Library, the National Science Library, the Archives and the headquarters of every government department, the city is an excellent base of operations for sociological research.

The graduate program in anthropology enjoys an especially close relationship with the sociology graduate program and, while certain members of the Department are primarily identified as anthropologists, a number of sociologists may also be called upon for particular contributions to the program. There are other valuable resources in the School of International Affairs and the Committee on African Studies.

Qualifying Year Program

Applicants with general (pass) Bachelor's degrees may be admitted into a Qualifying Year program designed to raise their standing to Honours status. Students earning at least high second-class (B+) standing in their Qualifying Year courses will be considered for admission into the Master's program.

Refer to the general section of this Calendar

for details of the regulations governing the Qualifying Year.

Master of Arts in Sociology

Admission Requirements

The requirement for admission into the Master's program is an Honours B.A. (or the equivalent) with at least second-class standing. In current practice, a high second-class (B+) standing is normally required for admission into the program.

Program Requirements

Master's students in sociology are required to select and follow one of the optional program patterns below, chosen in consultation with a graduate adviser:

Thesis Program

- Three full courses (or the equivalent); under certain circumstances one of the courses may be selected from those offered at the senior undergraduate level.
- a thesis equivalent to two full course credits;
- an oral examination on the candidate's thesis and program.

Course Work Program

- Five full courses (or the equivalent); under certain circumstances one of the courses may be selected from those offered at the senior undergraduate level.
- written and oral examinations on the candidate's area of specialization;
- an oral examination on the candidate's program.

Academic Standing

A grade of B– or better must normally be obtained in each course counted toward the Master's degree. With the recommendation of the Department, a candidate may be allowed a grade of C (but not C–) in one full course or each of two half-courses.

Master of Arts in Anthropology

Admission Requirements

The requirement for admission into the Master's program is an Honours B.A. (or the equivalent) with at least second-class standing. In current practice, a high second-class (B+) standing is normally required for admission into the program.

Program Requirements

Master's students in anthropology are required to select and follow one of the optional program patterns below, chosen in consultation with a graduate adviser:

Thesis Program

Three full courses (or the equivalent) consisting of:

- one of 54.504 or 54.508;
- one of 54.516 or 54.517;
- one and one-half additional credits selected from the anthropology graduate course offerings; from courses offered in the sociology graduate program (especially in theory and methods); from 400-level courses offered in the sociology and anthropology undergraduate program; or any combination of these selected in consultation with the student's graduate adviser. Courses in other programs in the University may also be selected (for example, Political Science 47.581), but not in excess of one full course (or the equivalent).
- a thesis equivalent to two full course credits;
- an oral examination on the candidate's thesis and program.

Course Work Program

Five full courses (or the equivalent) consisting of:

- both 54.504 and 54.508;
- both 54.516 and 54.517;
- two additional course credits as described in the thesis program above, chosen in consultation with the student's graduate adviser;
- a written and oral comprehensive examination on the candidate's program.

Academic Standing

A grade of B– or better must normally be

obtained in each course counted toward the Master's degree. With the recommendation of the Department, a candidate may be allowed a grade of C (but not C–) in one full course or each of two half-courses.

Doctor of Philosophy in Sociology

The substantive focus of the Ph.D. program is the organization and development of modern societies, both in a comparative context and with particular reference to Canadian society.

Admission Requirements

The minimum requirement for admission into the Ph.D. program is a Master's degree (or the equivalent) in sociology, with a minimum average of B+ in courses (including the thesis where applicable), and with no grade below B.

Applicants who have deficiencies in certain areas may be admitted into the Ph.D. program, but will normally be required to complete additional course work.

Program Requirements

The specific program requirements of the Department of Sociology and Anthropology are the following:

- ten full courses (or the equivalent), including 53.600 and a thesis equivalent to a maximum of seven full courses or a minimum of five full courses;
- written and oral comprehensive examinations in three areas of specialization;
- an oral examination on the subject of the thesis and fields related to the candidate's Ph.D. program.

Comprehensive Examinations

Each Ph.D. candidate is required to write a total of three comprehensive examinations. At least one (but not all) of the three examinations will be undertaken in a sub-area of comparative social organization; the sub-areas are comparative societies, comparative institutions, occupations and formal organizations, social stratification and mobility, social anthropology.

The remaining comprehensive examinations must be undertaken in:

- social demography-ecology, and/or
- theory-methodology

An approved field in a related discipline may be substituted for one of the areas listed above.

The comprehensive examinations are normally undertaken after completion of at least one year of Ph.D. study, and must be successfully completed at least one term before the oral defence of the thesis.

Language Requirements

The Department of Sociology and Anthropology requires each Ph.D. candidate to demonstrate an understanding of a language other than English. Although French is the preferred second language, students may be permitted to substitute another language if it is demonstrably relevant to their professional interests. It is strongly advised, however, that all English-speaking candidates be proficient in French. The language requirements may be satisfied by a demonstration of reasonable understanding, on sight, of material contained in selected samples of the sociological literature in that language. Students may find it necessary or advisable to take a course in the required language before undertaking the Departmental language examination.

Academic Standing

Candidates must obtain a grade of B– or better in each course and on the comprehensive examinations.

Graduate Courses*

- Sociology 53.500F1
Traditional Theory: Marx's Sociology
Marx's sociology and his theories of ideology,

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

social class, social change (historical materialism), surplus value and political sociology.
Gertrud Neuwirth.
Credit will not be given for both 53.500 and Political Science 47.431.

• Sociology 53.503W1
Social Action
A consideration of selected writings by Max Weber, G.H. Mead, E. Goffman, A. Schuetz, P. Berger, T. Luckman, and H. Garfinkel. The focus of this seminar is the development of the concept and theory of social action as it was originally formulated by Max Weber and G.H. Mead and subsequently modified and applied by other writers.
Gertrud Neuwirth.

• Anthropology 54.504T2
Ecological Anthropology
An examination of selected theoretical, methodological, and substantive issues, both historical and contemporary, in ecological anthropology. Special emphasis is given to problems of systems analysis, the epistemological status of ecological data and ecological explanation. Selected cases in North America and other ethnographic regions will be considered.
Valda Blundell.

• Sociology 53.507W1
Social Change and Economic Development
A critical examination of studies of change and development in historical and contemporary national and transnational systems.
D.R. Whyte.

• Anthropology 54.508T2
Structural Analysis and Formal Models
Theoretical and methodological problems in formal systems analysis such as behaviourist models in anthropology, decision theory, exchange theory, and structuralism are examined through a consideration of current issues in these areas.
J.I. Prattis.

• Sociology 53.509F1
Philosophy of Social Science I
The seminar considers the philosophy of language and the basic elements of scientific method, such as the classification of the sciences, the concepts of value, cause and probability, induction and deduction, confirmation of hypotheses, and the concept of truth.

• Sociology 53.510W1
Philosophy of Social Science II
An examination of some important issues in the philosophy of science. Topics include scientific laws, theory, explanation and prediction; conceptual frameworks; models, operational definitions and indicators; and the controversial nature of collective properties in the social sciences.
Prerequisite: Permission of the instructor.
John Harp and Gertrud Neuwirth.

• Sociology 53.512F1
Statistical Methods I
The focus will be research design and sampling designs. Various data-collecting methods will be examined and the strengths and weaknesses of various sample designs will be considered. The basic foundations of statistical analysis will be laid.
Hugh McRoberts.

• Sociology 53.513W1
Statistical Methods II
The focus will be advanced research methods. Topics will include distributions, sampling distributions, hypothesis testing, and non-parametric methods. There will be an introduction to multivariate techniques including regression and log-linear models.
Hugh McRoberts.

• Sociology 53.515W1
Selected Topics in Social Research
An examination each year of a particular research method. This year the topic will be secondary data analysis.
John de Vries.

• Anthropology 54.516F1
North American Ethnography
Issues in traditional and contemporary problems in theory and method in North American ethnography. Ethnographic approaches to problems of social and cultural change are also considered. Ethnographic case materials, principally (but not exclusively) dealing with North American Indians and Eskimos, are emphasized.
D.G. Smith.

• Anthropology 54.517W1
Sub-Saharan African Ethnography
Issues in traditional and contemporary ethnographic theory; research techniques in Africa south of the Sahara. Ethnographic approaches to social and cultural change are also considered. Selected ethnographic regions and problems are emphasized from year to year.

• Sociology 53.520W1
Comparative Social Systems
The seminar explores both perspectives and research procedures employed by sociologists in the systematic and explicit comparison of data from two or more societies. Major emphasis is placed on theoretical and methodological issues in comparative research. Included among the topics for discussion are the following: the nature of sociological propositions in comparative research, the problem of conceptual equivalence, research designs and levels of analysis. Examples are drawn from both classical and contemporary comparative studies.
Judah Matras.

• Anthropology 54.523F1
Kinship Systems
An examination of current theoretical and methodological problems and substantive issues in the analysis of kinship systems, in both descent and alliance theory.
Charles Laughlin.

• Sociology 53.525T2
Canadian Society
A critical examination of sociological models of modern societies and their relevance to Canada. Special attention is given to current research and its application to contemporary issues.
John Porter and F.G. Vallee.

• Sociology 53.526F1
Sociology of Occupations and Professions
A consideration of the development of occupational recruitment patterns and manpower problems in developed and developing areas.
B.A. McFarlane.

• Sociology 53.527F1
Sociology of Formal Organizations
A consideration of the forms and processes of bureaucracy in modern society, government and industry.
A.D. Steeves.

• Sociology 53.530F1
Social Institutions
An exploration of notions of property and ownership in the development of capitalist society.
C.C. Gordon.

• Sociology 53.535W1
Sociology of Religion
This seminar concentrates upon the study of religious phenomena and systems as interpreted by classical and contemporary sociological theory. Four major topical areas are treated: the sociological interpretation of religion; religion as a social system; religion, society and social change; and religion and social science.
Gordon Irving.

• Sociology 53.540W1
Political Sociology
An examination of the sociological dimensions of power, politics, and political behaviour. Particular attention is placed upon class politics, and the role of labour organizations in Canadian society.
George Ross.

• Sociology 53.545W1
Power and Stratification
An examination of theories of elite behaviour, social class and ideology.
Judah Matras.

• Sociology 53.566F1
Contemporary Socio-Demographic Problems
Marriage and fertility: trends and differentials in nuptiality and mate-selection and in fertility and family size will be studied; research and hypotheses concerning causes and correlates of these trends and differentials will be reviewed critically.
Judah Matras.

• Sociology 53.583W1
Departmental Seminar: Modern Marxist Theory
Neo-Marxist analysis of the various institutional areas, including works on the family, state, education and stratification.
Dennis Olsen.

• Sociology 53.585F1
Selected Topics
Topic for 1978-79: Social Movements and Industrial Change
George Ross.

• Sociology 53.586W1
Selected Topics
Topic for 1978-79: Sociology of Law
Adam Podgorecki.

• Anthropology 54.587W1
Selected Topics in Anthropology
Topic for 1978-79: Anthropology of Canadian Politics
An application of anthropological methods and perspectives to an understanding of Canadian political symbolism, processes and institutions. Special attention will be paid to such topics as political rituals, value systems, patron-client relations, community structure, electoral behaviour, and party organizations.
Jacques Chevalier and K.Z. Paltiel.
(Also offered as Political Science 47.507)

• Sociology 53.589F1
The Logic of the Research Process
An examination of the research process, including the phases of conceptualization, choice of indicators, sampling, data collection, and analysis. Published articles will be studied as exemplars of the range of possible research strategies.
Hugh McRoberts and Stephen Richer.

• Sociology 53.590F1, W1, S1
Tutorial

• Anthropology 54.590F1, W1, S1
Tutorial

• Sociology 53.599F4, W4, S4
M.A. Thesis

• Anthropology 54.599F4, W4, S4
M.A. Thesis

• Sociology 53.600T2
Doctoral Seminar
This course, an examination and review of the major areas of theory and research of Departmental concern in the Ph.D. program, is required of all incoming Ph.D. students in their first year of residence. Other Ph.D. students still in residence are strongly urged to participate in this seminar.
D.P. Forcese and Stephen Richer.

• Sociology 53.601F1
Selected Topics in Sociology

• Sociology 53.602W1
Selected Topics in Sociology

• Sociology 53.690F1, W1, S1
Tutorial

• Sociology 53.699F, W, S
Ph.D. Thesis

Courses Not Offered in 1978-79

53.501 Traditional Theory: Durkheim and Weber
53.502 Contemporary Theory: Social Behaviourism
53.505 The Sociology of Knowledge
53.506 Theories of Social Organization and Change
53.514 Multivariate Analysis
53.521 Comparative Methods in Social Research
54.522 Economic Anthropology
53.529 Sociology of Science and Technology
53.531 Social Institutions II: Education
54.536 Symbolic Systems
54.539 Political Anthropology
53.550 National Unity in Multi-Ethnic Societies
53.560 Human Ecology
53.575 Workshop in Macro-Sociological, Demographic and Ecological Problems

The Institute

Director of the Institute: C.H. McMillan

A Committee on Soviet and East European Studies was formed in 1963 to foster interdisciplinary studies, research, conferences and publications in this area. The Committee was transformed into the Institute of Soviet and East European Studies in 1970. Faculty members from seven disciplines (economics, geography, history, law, political science, Russian and sociology) participate in the Institute's programs; they are joined on an occasional basis by visiting scholars from outside the University, including invited specialists from the U.S.S.R. and Eastern Europe.

At the undergraduate level, the Institute offers an interdisciplinary B.A. Honours program in Soviet and East European studies. The Institute also administers a program of interdisciplinary studies leading to a Master of Arts degree in Soviet and East European studies, the only one of its kind in Canada. The curricula for both programs are offered largely through participating departments. The M.A. program is designed for students wishing to acquire specialized knowledge of the Soviet and East European area, including proficiency in the use of Russian as a research tool; the approach is interdisciplinary with emphasis on the social sciences and history.

Qualifying Year Program

Applicants with a general (pass) Bachelor's degree in one of the disciplines represented in the program may be admitted to a Qualifying Year program designed to raise their status to that of Honours graduates.

To be eligible for admission to the Qualifying Year program, an applicant must already have taken some courses in the area of Soviet and East European studies, so that by the end of the program he or she shall have satisfied the basic requirements for admission to the Master's program. Students are expected to achieve high second-class standing (B+) in Qualifying Year courses in order to qualify for admission to the Master's year.

Master of Arts

Admission Requirements

The normal requirement for admission to the Master's program is an Honours degree (or the equivalent) in Soviet and East European Studies, with at least high second-class (B+) standing.

Honours graduates in other disciplines are eligible for admission provided they meet the following requirements:

- A knowledge of the Russian language sufficient for its use in research; in exceptional cases the Institute may permit the substitution of another Slavic or East European language.
- a total of seven full courses (or the equivalent) in the Soviet and East European field, taken in no fewer than three different departments;
- at least high second-class standing.

Candidates with an insufficient course background may be admitted, but will be required to complete one or two additional courses. In some cases candidates may be required to enter the Qualifying Year.

Program Requirements

The specific requirements in the Master's program are the following:

- Soviet Studies 55.500, Interdisciplinary Seminar on the Soviet Union and Eastern Europe: a comprehensive seminar on the Soviet Union and Eastern Europe incorporating the approaches of several relevant disciplines.
- two full courses, or the equivalent, chosen from the following list, with at least one full course (or the equivalent) at the 500 level. Students are advised to check with the relevant departments for final course listings for 1978-79, as changes in curricula may be made too late for inclusion below.

Economics
43.570 Comparative Economic Systems

Geography
45.571 Selected Studies in the Human Geography of Arctic and Subarctic Lands

History
24.460 Selected Problems in Russian History
24.461 Selected Problems in Soviet History
24.560 Late Imperial and Revolutionary Russia
24.588 Historiography (section dealing with Modern Russia)

International Affairs
46.520 Strategy and Security
46.521 Strategy and Security
46.535 The Political Economy of East-West Relations
45.566 Integration in Eastern Europe

Law
51.420 International Economic Law II
51.421 International Economic Law III
51.488 Socialist Legal Systems

Political Science
47.431 Marxist Thought
47.432 Contemporary Communist Thought
47.461 Soviet Foreign Policy
47.462 International Communist Movement
47.514 Comparative Communist Politics: Theory and Practice
47.515 Comparative Communist Politics: Selected Aspects
47.516 Selected Problems in Soviet Politics

Russian
36.430 Russian Realism of the Nineteenth Century
36.440 Contemporary Russian Drama
36.450 Contemporary Russian Literature (after 1935)
26.460 Old Russian Literature
36.470 Modern Russian Literature

Sociology
53.545 Power and Stratification
53.550 National Unity in Multi-Ethnic Societies
53.583 Marx and Neo-Marxists

Soviet Studies
55.590 Tutorials in Soviet and East European Studies;

- one of the following:

55.598, a research essay incorporating the approaches of at least two of the disciplines represented in the program. The research essay must be combined with an additional full course (or the equivalent) chosen from those listed above; *or*

Soviet Studies 55.599, M.A. Thesis; the thesis must combine the interdisciplinary approach with a greater degree of originality than that required of the research essay, and must be defended orally.

- an oral comprehensive examination to determine the candidate's general competence in the area and his or her ability to relate at least two disciplines to the study of the USSR and Eastern Europe;
- In cases where, on admission, a student's command of the Russian language has been deemed insufficient, he or she may be required to pass a reading test in Russian.

Candidates are encouraged to incorporate study at an educational institution in Eastern Europe or the Soviet Union into their degree program. They are also encouraged to take a tutorial in one East European language other than Russian offered by the Department of Russian.

Academic Standing

Master's candidates must obtain a grade of B– on all work counted for credit towards the degree.

Graduate Courses*

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The themes of the seminar vary from year to year, but the continuing objective is to apply the approaches and methods of several relevant disciplines to selected issues and countries.

*F,W,S indicates term of offering.
Courses offered in the fall *and* winter (or any other two terms) will be followed by T.

The number following the letter indicates the credit weight of the course: 1 denotes a half-course credit, 2 denotes a full-course credit, etc.

• Soviet Studies 55.590F1, W1, S1
Tutorials in Soviet and East European Studies
A course of directed readings in selected areas of Soviet and East European studies, involving preparation of papers as the basis for discussion with the tutor. Offered when no regular course offering meets a candidate's specific needs.

• Soviet Studies 55.598F2, W2, S2
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A research essay on some topic relating to the Soviet Union or Eastern Europe.

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Carl Kropp*, B.Sc. Queen's, B.Sc., M.Sc. Carleton

W.R. LaLonde, B.A.Sc., M.A.Sc. Toronto, Ph.D. Waterloo

S.A. Mahmoud, B.Sc. Ain Shams, M.Eng., Ph.D. Carleton

L.R. Morris, B.A.Sc. Toronto, D.I.C. Imperial, Ph.D. London

J.E. Neilson, B.Sc. Manitoba, Ph.D. British Columbia

Bernard Pagurek, M.A.Sc., Ph.D. Toronto

Irwin Reichstein, B.Sc. McGill, Ph.D. Minnesota

J.S. Riordon, M.Eng. McGill, D.I.C. Imperial, Ph.D. London

M.E. Ulug, B.Sc., M.Sc. Durham, Ph.D. Carleton

C.M. Woodside, B.A.Sc. Toronto, Ph.D. Cambridge

Calendar of Milestones

The Institution

1941
The Ottawa Association for the Advancement of Learning was established to develop Carleton College. The next year the College offered only evening classes in introductory university subjects, with some courses in Public Administration.

1943
The incorporation of the Ottawa Association for the Advancement of Learning.

1945
Beginning of day classes and full-time teaching in Arts, Science, Journalism and first year Engineering. Establishment of the Faculty of Arts and Science.

1946
Move from rented premises to First Avenue campus, formerly Ottawa Ladies' College. First degrees awarded in Journalism and Public Administration.

1947
The College committed itself to develop pass and four-year Honours programs.

1949
First pass undergraduate degrees in Arts, Science and Commerce awarded. Formation of Senate.

1950
First Honours degrees in Arts and Science awarded.

1952
The Carleton College Act, 1952 passed by the Ontario Legislature. This changed the corporate name to Carleton College and confirmed the power to grant degrees. Property for Rideau River campus acquired.

1953
Establishment of the School of Public Administration.

1954
Appointment of Architectural Associates for Carleton to prepare a master plan for Rideau River campus and to design the first group of buildings. First honorary degree of LL.D. conferred on Dag Hammarskjold, Secretary-General of the United Nations.

1955
First Master of Arts degree awarded.

1957
The Carleton University Act, 1957. Establishment of the School of Engineering. Establishment of the Institute of Canadian Studies.

1958
First Master of Science degree awarded.

1959
Move to Rideau River campus, following construction of the Henry Marshall Tory Building (Science), the Maxwell MacOdrum Library and Norman Paterson Hall (Arts).

1961
First Ph.D. degree in Science awarded. First degrees in Engineering awarded.

1962
Southam Hall, the University Commons, Renfrew House and Lanark House (residences) completed. Paterson Hall extended and University Union opened.

1963
First Master of Engineering degree awarded. Reorganization into Faculties of Arts, Engineering, Science, and Graduate Studies.

1964
The C.J. Mackenzie Building (Engineering) completed.

1965
The E.W.R. Steacie Building (Chemistry), Grenville House and Russell House (residences), Maintenance Building and Heating Plant completed.

1966
First Ph.D. degree in Engineering awarded. The Physics Building completed (designated in 1972 as the Herzberg Laboratories). Establishment of the Schools of International Affairs and Commerce.

1967
Loeb Building (Social Sciences) completed. Integration of St. Patrick's College as a division of the Faculty of Arts. Integration of the School of Social Work.

1968
First Ph.D. degree in Arts awarded. First Master of Social Work degree awarded. Establishment of the School of Architecture.

1969
Controlled Environmental Facility (biology), Administration Building, Glengarry House (residence) and University Commons (residence cafeteria) completed.

1970
University Centre and Parking Garage completed.

1971
Arts Tower completed.

1972
Architecture Building completed. School of Social Work accommodated on the Rideau River campus.

1973
St. Patrick's College moves to new facility on the Rideau River campus. First degrees in Architecture awarded. New athletic complex containing 50-metre pool and fitness centre opened. School of Industrial Design established.

1974
Faculty of Graduate Studies expanded into Faculty of Graduate Studies and Research. School of International Affairs renamed the Norman Paterson School of International Affairs. Master of Journalism program approved for September 1974. Master of Arts programs in Anthropology and in Religion approved for September 1975. Program leading to Certificate in Teaching of English as a Second Language established.

1975
Lester B. Pearson Chair for International Affairs approved for January 1, 1975. Establishment of Gerhard Herzberg Lecture Series in Science. First students enroll in Public Policy and Management Program offered jointly with the University of Ottawa.

1976
First Dunton Alumni Award presented, January 1976. Creation of The Paterson Centre in March 1976. Division of the Faculty of Arts into two separate faculties: the Faculty of Arts and the Faculty of Social Sciences, effective July 1976. First Master of Journalism degrees awarded, November 1976.

1977
Opening of the Criminology and Corrections Program at St. Patrick's College, April 1977.

Presidents

1942—1947
Henry Marshall Tory

1947—1955
Murdoch Maxwell MacOdrum

1955—1956
James Alexander Gibson (acting)

1956—1958
Claude Thomas Bissell

1958—1972
Davidson Dunton

1972—
Michael K. Oliver

Chancellors

1952—1954
Harry Stevenson Southam

1954—1968
Chalmers Jack Mackenzie

1969—1972
Lester Bowles Pearson

1973—
Gerhard Herzberg

Graduate Diplomas and Degrees Awarded

	D.P.A.	M.A.	M.Sc.	M.Eng.	M.J.	M.S.W.	Ph.D.
1954	3						
1955	3	1					
1956	4	3					
1957	1	2					
1958	3	3	1				
1959	10	3	—				
1960	8	2	—				
1961	11	11	2				1
1962	4	13	7				—
1963	15	6	7	1			—
1964	9	19	5	2			1
1965	26	32	8	16			2
1966	18	59	13	15			5
1967	26	55	14	21			2
1968	28	88	21	22		34	12
1969	26	117	23	18		38	14
1970	34	142	32	29		44	10
1971	46	137	36	27		41	17
1972	34	193	29	41		47	19
1973	26	154	32	31		54	28
1974	20	164	18	30		51	17
1975	19	145	27	25		54	22
1976	28	195	30	47	3	58	14
1977	11	223	35	54	3	50	17
Total	413	1767	340	379	6	471	181

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